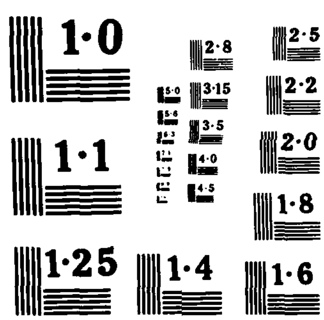
AD-A156 513 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/2
STINSON LAKE DAM (NH..(U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV OCT 78

UNCLASSIFIED F/G 13/13 NL


1·0
2·8
2·5
3·15
2·2
5·0
3·5
2·0
1·1
4·0
4·5
1·8
1·25
1·4
1·6

AD-A156 513

MERRIMACK RIVER BASIN
RUMNEY, NEW HAMPSHIRE

STINSON LAKE DAM
NH 00399

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS, 02154

OCTOBER 1978

DISCLAIMER NOTICE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 24 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Stinson Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire and owner of the project.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00399	2. GOVT ACCESSION NO. AD-A156513	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Stinson Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE October 1978
		13. NUMBER OF PAGES 68
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Merrimakc River Basin
Rumney, New Hampshire
Stinson Brook Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

~~The dam~~ is a low concrete masonry gravity dam 158 ft, long and 7.7 ft. high. The overall condition of the dam is good. The spillway cannot pass the estimated PMF discharge, having a capacity of about 40% of the PMF without overtopping the dam. More hydrological and hydraulic studies are recommended.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

STINSON LAKE DAM

NH 00399

MERRIMACK RIVER BASIN

GRAFTON, NEW HAMPSHIRE

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Stinson Lake Dam, I.D. NH 00399
State Located:	New Hampshire
County Located:	Grafton
Stream:	Stinson Brook
Date of Inspection:	June 5, 1978

BRIEF ASSESSMENT

Stinson Lake Dam is a low concrete masonry gravity dam 158-foot long and 7.7-foot high. Its spillway is 100-foot long and the dam has a small low level outlet section controlled by stop planks.

The overall physical condition of Stinson Lake Dam is good. However, preliminary analyses indicate that the spillway cannot pass the estimated probable maximum flood (PMF) discharge, having a capacity of only approximately 40 percent of the PMF without overtopping the dam. More detailed hydrologic and hydraulic studies are therefore recommended: (a) to determine the adequacy of the spillway capacity, (b) the ability of the dam to withstand some overtopping, and (c) the possible submergence effect of downstream backwater during large floodflows.

Recommended actions to be carried out by the owner within 24 months of receipt of this Phase I Report are summarized in Section 7. The most important of these is the acquisition of additional data to assess the need for additional spillway capacity, and the assembly of a complete set of design documents for the dam.

Robert Gershowitz, PE

Robert Gershowitz, P.E.

This Phase I Inspection Report on Stinson Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe condition be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

TABLE OF CONTENTS

(Continued)

APPENDICES

STINSON LAKE DAM

Looking toward the right abutment. The low level outlet stop plank section is in the foreground, on the left abutment.

Quadrangle: Rumney, New Hampshire
Scale: 1 : 62,500

VICINITY MAP

PHASE I INSPECTION REPORT

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. HARRIS-ECI ASSOCIATES has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to HARRIS-ECI ASSOCIATES under a letter of June 7, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0305 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Project Description

a. Location

Stinson Lake Dam is located on Stinson Brook in the Town of Rumney, Grafton County, New Hampshire, upstream of a town road crossing the brook. Stinson Brook is a tributary of Baker River, and part of the Merrimack River drainage basin.

b. General Description of Dam and Appurtenances

Stinson Lake Dam consists of a low concrete spillway placed across the mouth of the Lake Stinson. The central spillway is flanked on the right abutment by a spillway wing wall and a short core wall into higher ground. On the left abutment, the spillway is flanked by twin 48-inch wide low level outlet passages and an abutment wingwall. The left abutment area is flat for the first 80 to 90 feet adjacent to the spillway and then rises at a sharper slope. The left abutment cutoff is effected by a concrete core wall connecting to the abutment wingwall. The core wall length is given as 39 feet according to drawings supplied by the N.H. Water Resources Board (NH-WRB).

The concrete spillway is 3 ft.-9 in. high above the lake bottom and has an 18-inch thick upstream cutoff wall extending down to an impervious layer. The cutoff wall varies in depth, but is typically shown as 3 ft-6 in. deep. A line of sheeting has apparently been driven under the concrete cutoff wall beneath the spillway to a shallow depth, but the available sheeting information is not fully consistent with the dam cross section plans. Downstream of the spillway, a short level apron has been provided to control channel scour. The apron is wider on the left part of the spillway than on the right, and has been provided with drainage relief holes and an end cutoff wall which is 2-foot deep.

The twin low level outlet passages are 4-foot wide and extend down to the full height of the spillway weir. The passages are controlled by individual stop log planks 2.5-inch thick by 7.5-inch high placed in stop log grooves that are normally kept locked. The stop logs can be manually removed from a concrete catwalk above the passages.

The concrete spillway crest is ogee shaped and has a 45-degree approach lip over a vertical upstream face.

The lake rim is generally flat for the first 6 to 10 feet above the water surface and then rises sharply. Riprap lake rim protection has been provided for a short length upstream of both abutment wingwalls.

The downstream channel of Stinson Brook immediately downstream of the dam is well defined with fairly steep bank slopes which are heavily vegetated. There is some vegetation and aquatic growth in the channel but not enough to affect the tailwater levels. Substantial riprap protection has been provided along both brook banks downstream of the abutment wingwalls. The downstream channel is crossed by an improved road and a reinforced concrete bridge some 80 yards downstream of the dam axis.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "Intermediate", since its storage is more than 1,000 acre-feet but less than 50,000 acre-feet. The dam is also classified as "Small" because its height is less than 40 feet. The overall size classification is determined by the larger of these classifications, and thus Stinson Lake Dam is classified as "Intermediate" in size.

d. Hazard Classification

The dam has been classified High Hazard Potential in the Inventory of Dams in the United States maintained by the U.S. Army Corps of Engineers, on the basis that in the event of failure of the dam and its appurtenances, excessive damage could occur to downstream property together with the possibility of the loss of more than a few lives. We concur with this assessment, for the following reasons:

(1) The dam impounds a substantial volume of water, and is founded on erodible materials.

(2) The reservoir is located some 4 miles upstream of the village of Rumney, and at an elevation of 800 feet above the altitude of the village.

(3) In case of a hypothetical dam failure, the village would have only some 20 minutes to implement emergency measures against on-rushing waters.

e. Ownership

Stinson Lake Dam is owned by the New Hampshire Water Resources Board, headquartered at Concord, New Hampshire.

f. Operator

Stinson Lake Dam is operated by the New Hampshire Water Resources Board headquartered at Concord, New Hampshire - Telephone (603) 271-3405.

g. Purpose of Dam

The dam is operated as a State recreation facility for small boating and fishing.

h. Design and Construction History

The dam was designed in 1954 by the New Hampshire Water Resources Board and completed in 1955. The new dam replaced a leaking timber structure at the site owned by the Town of Rumney. An impounding structure of the same kind has been located at this site since the late 18th Century.

i. Normal Operating Procedures

The normal operating procedure is to allow the stream water to flow over the spillway, keeping the low level outlet passages closed. The low level outlet passages are not normally opened during high and intermediate frequence rainstorms. The low level outlets are used to drawdown the lake level in the late fall in anticipation of spring runoffs. The dam is visited at monthly intervals to regulate the lake level as needed.

1.3 Pertinent Data

a. Drainage Area — 7.8 square miles

b. Discharge at Dam Site

Maximum known flood at dam site:	740 cfs, June 15, 1942
Warm water outlet at pool elevations:	NA (not applicable)
Diversion tunnel low pool outlet at pool elevation:	NA
Diversion tunnel outlet at pool elevation:	NA
Gated spillway capacity at pool elevation:	NA
Gated spillway capacity at maximum pool elevation:	NA
Ungated spillway capacity at maximum pool elevation:	3,080 cfs (Lake Elev. 1,307)
Total spillway capacity at maximum pool elevation:	3,080 cfs (Lake Elev. 1,307)

c. Elevation (feet above MSL)

Top of dam:	1,307
Maximum pool design surcharge:	1,307
Full flood control pool:	NA
Recreation pool:	1,303
Spillway crest:	1,303
Upstream portal invert diversion tunnel:	NA
Downstream portal invert diversion tunnel:	NA
Streambed at centerline of dam:	1,299.3
Maximum tailwater:	NA

d. Reservoir

Length of maximum pool:	9,700 feet
Length of recreation pool:	9,000 feet
Length of flood control pool:	NA

e. Storage (acre-feet)

Recreation pool:	7,000 (Elev. 1,303)
Flood control pool:	NA
Design surcharge:	8,400 (Elev. 1,307)
Top of dam:	8,400 (Elev. 1,307)

f. Reservoir Surface (acres)

Top of dam:	350 (Elev. 1,307)
Maximum pool:	350 (Elev. 1,307)
Flood control pool:	NA
Recreation pool:	346 (Elev. 1,303)
Spilwway crest:	346 (Elev. 1,303)

g. Dam

Type:	Central concrete spillway with earth abutment on left side
Length:	158 feet
Height:	7 feet-8 inches
Top width:	varies
Side slopes - Upstream - Downstream	) There are no defined slopes on) the abutment sections which are) massive
Zoning:	Unknown
Impervious core:	Concrete core wall down to impervious stratum
Cutoff:	Some sheet piling of shallow depth at central spillway section
Grout curtain:	None

h. *Diversion and Regulating Tunnel*

Type:	NA
Length:	NA
Closure:	NA
Access:	NA
Regulating facilities:	NA

i. Spillway

Type:	Concrete ogee weir
Length of weir:	100 feet
Crest elevation:	1,303
Gates:	None
U.S. Channel:	None
D/S Channel:	Concrete apron, leading to the natural channel of Stinson Brook

j. <u>Regulating Outlets</u>

Low level outlet:	Twin 48-inch wide passages, sill at Elevation 1,299.25
Controls	Individual stop logs, 2.5-inch wide by 9.5-inch high
Emergency gate:	None
Outlet:	Paved outlet area which is part of the downstream spillway apron

SECTION 2

2. ENGINEERING DATA

2.1 Design

A set of drawings for the dam, as designed in 1954, exists in the files of the New Hampshire Water Resources Board (NH-WRB), consisting of a topographic survey plan, and a detailed plan and cross section of the concrete spillway and adjacent low level outlet passages. A record plan of as-built sheeting depths at the spillway has also been supplied by the NH-WRB. Computations in the NH-WRB files show that the spillway was designed to pass a 15-year flood flow of 705 cfs at a head of 18 inches over the crest, and a 100-year flow of 2,206 cfs at a head of 3.53 feet.

Simple stability computations were made at the time of the design, considering water levels up to the top of dam, and determining that the resultant of forces was in the middle third. An allowance of 1,180 lbs per lineal foot was made for ice loadings at the top of the spillway crest. Uplift was not considered in the stability computations, nor were the effects of tailwater levels or lake siltation included. No assessment of a factor of safety against sliding was made.

No data on foundation design criteria was uncovered.

2.2 Construction

The available data on construction is limited to notations on the design drawings which show the as-built depth of sheeting. This information is not fully understandable in comparison to the designed cross section of the concrete weir. The actual depth of the impervious layer under the

spillway cutoff wall is not documented. No narrative reports were uncovered in the NH-WRB files concerning the construction of the dam during 1954 or its foundation.

2.3 Operation

No data concerning the operation of the dam relative to its safety were uncovered. The dam is operated by a knowledgeable organization experienced in the regulation of lake impoundments.

2.4 Evaluation

a. Availability

The availability of data concerning Stinson Lake Dam is fair as far as design is concerned and very sparse in the construction and operation categories. The data should be augmented.

b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual insepction, past performance history and sound engineering judgment.

c. Validity

The available data on the dam's construction drawing is not fully correct in that the downstream apron is not built according to the way the plans show it, but the rest of information matches what can be seen in the field, and is considered valid. The stability analysis carried out in connection with the spillway design is not considered adequate or valid.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

Stinson Lake Dam, as reconstructed in 1954, is in good condition and does not show any signs of distress. The visual inspection check list is included in Appendix A.

b. Dam

- Spillway Section

  The spillway concrete is in good to excellent condition, showing no surface cracking and very little surface deterioration due to water erosion of freeze thaw spalling. All surfaces are smoothly and accurately formed and in good horizontal alignment. The vertical alignment of the spillway crest is good and is estimated to vary less than one inch over its length. No monolith joints were visible in the spillway section and no construction joint offsets were noted. The downstream spillway apron was under water and could not be observed in detail, but its condition did not suggest that it was in distress.

- Outlet Works

  The concrete surfaces of the twin passages of the low level outlet showed no signs of deterioration. The stop log slots were cleanly formed and the stop log sections were in good serviceable condition. The access catwalk concrete was in good condition, allowing for the safe operation of the stop logs.

- Embankment and Abutments

  The right abutment rises steeply from the right spillway abutment wingwall. The top surface of the short core wall connecting to the wingwall is visible for a short distance. This abutment showed no signs of leakage.

  The left abutment wingwall ties into the left abutment embankment section, which is a grassed over wide and flat area, approximately 1 to 2 feet above the nominal top of the dam. A short section of core wall is visible at its juncture with the left abtument wingwall. There are no signs of seepage or leakage in this abutment area or downstream of it. The upstream faces of the lake banks are protected with heavy stone riprap in good condition, showing no signs of sloughing. Vegetation has taken root in the riprap interstices.

- Foundation and Geological Setting

  The dam is at the downstream end of an apparent glacial curved basin (lake). A few small-volume springs, occuring within 30-50 feet of the reservoir edge on the left valley wall, suggest a thin veneer of soil, or ground moraine, mantling bedrock. Relatively unweathered blocks (quartz-monzonite) are scattered over the slopes. A dug well about 15 feet deep was noted about 200 feet upstream of the right abutment. The dimensions given for cutoffs for the spillway, outlet and wingwalls suggest also that the dam is founded on a ground moraine.

c. Appurtenant Structures

There are none in this installation.

d. Reservoir Area

In general, up to a point 6 to 10 feet above the lake level, the lake rim is fairly flat, and then it slopes upward more sharply. No signs of instability of the terrain around the lake are readily apparent. The lake shore area is covered by trees and is sparsely developed. The shore is in the natural state and not protected against shoreline erosion except as noted above in the vicinity of the upstream spillway wingwalls. There are some signs of sedimentation at the right side of the spillway, where the approach channel appears to be significantly shallower than indicated on the dam drawings.

e. Downstream Channel

The immediate downstream channel is well defined with sharply sloping banks that have been protected by substantial riprap blocks for the first 100 feet downstream of the dam axis. The riprap protection was in good condition with no signs of sloughing or displacement. The riprap is in part overgrown with brush and small trees. Some aquatic growth was noted in the downstream channel, but this was not considered to affect the ability of the channel to convey the spillway discharges.

3.2 Evaluation

The dam inspection showed that the overall condition of Stinson Lake Dam is good, but that improvements could be made as described in Section 7.3.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Stinson Lake Dam is operated as a simple overflow structure, with summertime lake levels controlled by the depth of water required to pass the discharges over the spillway. In the late fall, the lake level is drawn down a few feet to allow for increased spring time lake inflows. The drawdown is accomplished by removing several stop log planks in the low level outlet passages. The dam is visited by a gate operator of the N.H. Water Resources Board (NH-WRB) at regular intervals to check the lake level and, in general, the facility. Control of the lake surface is directed by NH-WRB engineers in Concord, N.H. whose orders are carried out by the dam operators.

4.2 Dam Maintenance

Maintenance of the dam is on an as-needed basis, based on the reports by the dam operators.

4.3 Maintenance of Operating Facilities

The stop log passages are maintained in connection with the periodic visits to the dam site on an as-needed basis.

4.4 Description of any Warning System in Effect

No warning system has been established to alert downstream residents of possible dam misfunction, overtopping, or high stream stages.

4.5 Evaluation

Operational procedures are simple in line with the simple facilities. A formal bi-annual inspection should be initiated utilizing the current format of the Corps of Engineers check list. Logs should be kept of the operation and maintenance of the low level outlet gate. Records should be kept of water levels in the lake and in the stream during unusual storm events and pond dewaterings. Staff gages should be installed to aid in these loggings, keyed to the crest elevation of the spillway.

The downstream spillway apron should be dewatered at a convenient time and inspected at 10-year intervals.

Even though the dam is normally unattended, it would be desirable to establish some sort of communication channels to the downstream community of Rumney, to alert it to the possibility of impending high stream stages in case of dam failure, surveillance should be provided during periods of unusually heavy precipitation.

S E C T I O N   5

5. HYDRAULIC / HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The evaluation of the hydraulic and hydrologic features of Stinson Lake Dam was based on criteria set forth in the Corps' Guidelines for Phase I inspections, and additional guidance provided by the New England Division, Corps of Engineers. The Probable Maximum Flood (PMF) was estimated from guide curves for probable maximum flood for the New England region, based on past Corps of Engineers studies. The PMF peak flow versus drainage area curves are presented in the section of Hydrologic Computations.

The PMF curve applicable for rolling areas was adopted for the estimation of the PMF peak of the reservoir. The PMF versus drainage area relationship can be expressed mathematically as follows:

$$Q = 2323 - 676.99 \text{ Log}_{10} A$$

$$Qp = Q \times A$$

where:

Q = Unit peak discharge in cfs/square miles

Qp = Peak PMF discharge, in cfs, for the reservoir

A = Watershed area, in square miles, upstream of the dam axis.

The computed peak discharges of the PMF and one half of the PMF for a drainage area of 7.8 square miles using the above equation are 13,400 cfs and 6,700 cfs respectively. A triangular shaped flood hydrograph was assumed for the inflow design hydrograph.

Both the PMF and one half the PMF inflow hydrographs were routed through the reservoir by the modified Puls Method, utilizing computer program HEC-1. The peak outflow discharges for the PMF and one half of PMF are 10,392 cfs and 4,491 cfs respectively. Both the PMF and one half of the PMF result in overtopping of the dam.

The spillway and overtop rating curve was prepared by assuming a free overflow across the whole length of the spillway and dam. Effects of tailwater submergence were not considered. The reservoir stage-capacity were constructed using comparisons of both dam inventory data and planimetered areas, measured from 15-minute quadrangle topography maps. Reservoir storage capacity included in surcharge levels exceeding the top of dam and the spillway rating curve, assumed that the dam remains intact during routing. In the routing computations, the discharge through the low level outlet facilities was excluded, due to its insignificant magnitude, as compared to the spillway discharge and the PMF. The spillway rating curve and the reservoir capacity curve are presented in the section of hydrologic computations.

Since the spillway of the dam is incapable of passing the PMF or one half PMF without overtopping the dam, an assessment of downstream hazards due to a flood wave that would result with a dam failure was also estimated. The magnitude of the flood wave was estimated using generally accepted "rule of thumb" computational procedures established by the New England Division, Corps of Engineers in combination with sound hydrologic engineering judgement. Flood routing of the dam break hydrograph for downstream areas are given in the section on hydrologic computations. The results of this computation shows that in the event of a hypothetical

dam failure at the time the lake level is at the top of dam, a lake discharge of approximately 4,391 cfs would be released. Flood stages in the downstream channel reaches would be as given in the following table:

TABLE 1

Distance Downstream of Dam Axis (Miles)	Est. Flood Stages (Feet)
1.0	7.9
2.0	8.8
2	7.5
3.3 (Rumney)	8.6

The flood stages would affect the structural stability of buildings in the downsteam reach whose foundations are below the hypothetical inundation level, and could cause significant property damage and possible loss of lives.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to the dam operator of the N.H. Water Resources Board, the dam was never overtopped in the past. The spillway and the two 48-inch stop plank passages blocked to Elev. 1,303 were designed to pass a peak discharge of 3,280 cfs withough overtopping the dam.

c. Visual Observations

The spillway structure is well maintained and the approach channel is well defined, but heavy sedimentation deposits were observed in the reservoir on the upstream side of the spillway crest. No urbanization or new developments were noted in the reservoir area. The immediate downstream channel is also well defined with heavy riprap along the river banks.

d. Overtopping Potential

As indicated in Section 5.1 - a., both the Probable Maximum Flood and one half of the Probable Maximum Flood, when routed through Stinson Lake Reservoir, result in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flows. The PMF and one half PMF overtopped the dam by 3.7 feet and 0.8 feet, respectively. The spillway and the two stop log passages closed to Elev. 1,303 are only capable of passing a flood roughly equal to 40 percent of the PMF without overtopping the dam.

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual observations do not cast any serious doubt on the stability of the dam. The spillway has passed all lake discharges since it was placed into operation in 1955 without noticeable distress. According to the NH-WRB dam operator, the dam has not been overtopped. The actual maximum discharge that has passed over the spillway since 1955 is not known.

b. Design and Construction Data

The computations available for review were made in connection with the dam design in 1954. Maximum water levels up to the top of dam were considered. The location of the resultant was computed to fall within the middle third of the base. Some allowances for ice pressures were made, amounting to 1,180 pounds per lineal foot of dam with the resultant still falling into the middle third. No uplift pressures on the base were considered and no effects of tailwater levels were included. Silt levels in the lake were not considered in the stability computations. No factor of safety with regard to sliding was computed.

No data is available in the NH-WRB files regarding the construction of the dam that would be of interest to the designed dam in connection with stability. No construction inspection report information on the subgrade soils, and depth of cutoff trenches has been uncovered.

c. Operating Records

No operating records have been uncovered that would affect the assessment of stability of the dam.

d. Post Construction Stability

There have apparently been no changes made to the dam since its completion in 1954, that would affect the assessment of its stability.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the Recommended Phase I Guidelines, does not warrant seismic analyses.

SECTION 7

7. ASSESSMENT / REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The overall condition of Stinson Lake Dam is good. The safety of Stinson Lake Dam is in question because the dam does not have adequate spillway capacity to pass the PMF or one half of the PMF without overtopping. Overtopping of the dam carries with it the danger of a washout of the left abutment area and possible progressive failure of the adjacent concrete spillway. The dam's as-built spillway capacity can pass only 40 percent of the PMF. The spillway capacity had been computed according to Corps of Engineers screening criteria. The actual spillway capacity should be determined by the owner using more precise and sophisticated methods and procedures.

The physical features of the dam are generally good, with the sole exception that trees and brush have overgrown the bank and slope riprap protection and should be removed.

b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency

The urgency of performing the recommendations and remedial measures are detailed below.

d. Need for Additional Investigations

There is no need for further investigations in this phase of the program. Recommended investigations to be carried out by the owner are listed below.

7.2 Recommendations

It is recommended that the owner within 24 months after receipt of this Phase I Report assemble the following information:

a. Data Acquisition

(1) An updated as-built set of drawings of the dam showing all pertinent details and correcting inadequacies and omissions on the presently available drawings.

(2) Additional topographic surveys should be made in the reach downstream of the dam axis including details of roadway bridge downstream of the dam.

b. Investigations

Determine and document the spillway capacity of the dam using more sophisticated and accurate methods than were used in the Phase I screening methodology employed in this report, including the routing of the inflow through the lake, and the assessment of the effects of tailwater levels in the immediate channel reach downstream of the dam.

Based on the results of the spillway capacity analysis, the owner should formulate plans for augmenting the spillway capacity, if shown necessary.

7.3 Remedial Measures

a. Alternatives

The alternatives available for increasing the spillway capacity are:

(1) Increasing the dam height at the abutments, thus permiting a higher discharge to pass over the spillway without overtopping.

(2) Providing for an auxiliary spillway on the left abutment by "hardening" the top of the abutment and reentry path to the downstream brook channel sufficiently to withstand emergency flows of PMF magnitude.

(3) Providing for a new service spillway, adjacent to the existing spillway, possibly gated, and utilizing the present spillway as an auxiliary discharge facility.

(4) A combination of any of the above alternatives.

b. O&M Maintenance and Procedures

The owner should initiate the following programs:

(1) Bi-annual inspection of the dam utilizing a visual check list similar to that used in this inspection report.

(2) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

(3) Assemble and keep on hand complete documentation of the dam design, as-built drawings, and any other data pertaining to the dam safety.

(4) Selectively clear trees in area downstream of the main spillway that could be uprooted during high spillway discharges and cause damage to or plugging of the roadway bridge immediately downstream of dam.

(5) Control the vegetative growth on the riprap bank protection.

(6) Dewater the downstream spillway apron at 10-year intervals and inspect for damage to the adjacent stream channel.

(7) Install headwater and tailwater gages at the dam and readout during severe rainstorms and at routine operating and maintenance visits to the dam.

(8) The owner should establish a formal system with local officials for warning downstream residents in case of emergency. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

APPENDIX A

CHECK LISTS:
- VISUAL OBSERVATIONS
- ENGINEERING, CONSTRUCTION MAINTENANCE DATA
- HYDRAULIC AND HYDROLOGIC DATA ENGINEERING DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam STINSON LAKE DAM County Grafton State New Hampshire Coordinators ______

Date(s) Inspection June 5, 1978 Weather Clear Temperature 60°F

Pool Elevation at Time of Inspection 1,303.15 M.S.L. Tailwater at Time of Inspection 1,300.45 M.S.L.

Inspection Personnel:

Seymour Roth
David Kerkes
Recorder: Seymour M. Roth

William Flynn
Lynn Brown

Yin Au-Yeung

Representing the Owner, New Hampshire Water Resources Board: Lyall Milligan, Dam Operator

Note: NA means not applicable

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	No leakage or seepage visible.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Short piece of concrete core walls is visible at each end behind spillway wingwall. No visible seepage or leakage.	
DRAINS	None	
WATER PASSAGES	2-4 foot wide low level outlet passages, see "Outlet Works"	
FOUNDATIONS	Apparently founded on glacial till (moraine).	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Concrete surfaces at left abutment outlet works in very good condition, rest of the spillway concrete looks older but is also in very good condition. There were no surface cracks visible.	
STRUCTURAL CRACKING	None observed any place.	
VERTICAL & HORIZONTAL ALIGNMENT	Horizontal alignment of spillway crest is good. Vertical alignment of crest is good with approximately one inch differential observed. The water flow over the spillway weir is smooth.	
MONOLITH JOINTS	No monolith joints were visible or detectable in the main spillway structure.	
CONSTRUCTION JOINTS	None visible.	

EMBANKMENT *

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No sloughing observed. The upstream and downstream embankment faces at the stream are heavily riprapped.	
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	* No formal embankment section exists on the right abutment. The spillway wingwall ties into higher ground. The left abutment embankment is massive, and broad - topped, and could serve as an auxiliary spillway.	
RIPRAP FAILURES	None. All riprap embankment and bank protection is in good condition but brush and trees have grown in the riprap.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Concrete core walls visible for short distance behind spillway wingwalls.	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	See comments under "Ungated Spillway" - Discharge Channel.	
INTAKE STRUCTURE	None	
OUTLET STRUCTURE	NA	
OUTLET FACILITIES	The outlet facilities consist of two 48-inch wide stop log passages at the left abutment. The bottom of the stop log passages is 3 ft.-9 in. below the spillway crest or 7 ft.-9 in. below the nominal top of the dam. The two passages are controlled by standard 2 1/2 x 8 1/2 individual stop logs, manually lifted. Entire facility is in good to excellent condition. The stop logs are locked into the guides.	
EMERGENCY GATE	None provided	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Smooth ogee crest. No signs of cracking, settlement, or distress was visible.	
APPROACH CHANNEL	No formal channel.	
DISCHARGE CHANNEL	A concrete apron has been provided downstream of the ungated weir. The apron width is apparently wider on the left abutment side than on the right. Drain holes are visible on the floor of the apron. Entire installation appears in good condition. Juncture of brook bed and apron appears stable with no undercutting apparent.	Unwater apron at low flow period and inspect concrete in greater detail for cracking or distress.
BRIDGE AND PIERS	None	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL	NA	
APPROACH CHANNEL	NA	
DISCHARGE CHANNEL	NA	
BRIDGE AND PIERS	NA	
GATES & OPERATION EQUIPMENT	NA	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	Tie spillway crest into USGS level system. Provide reservoir gage and tail-water gage.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	First 6-10 feet above lake level is fairly flat (1 on 10), then slopes get sharply steeper. Rim of lake is sparsely developed and wooded. No sloughing of rim terrain reading apparent.	
SEDIMENTATION	The lake water is very clear, but there is some evidence of sedimentation at the spillway near the right abutment where the water depth behind the ungated spillway is very shallow.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No obstructions noted. A highway bridge crosses the stream some 80 yards downstream. There is some aquatic growth in the brook channel downstream of the spillway on the right side of the channel.	
SLOPES	Well defined, moderately steep and stabilized by heavy rip-rap stone protection.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	One residence visible on left bank in the first 300 feet of the dam. There is sparse development along the brook in the 3.5 miles to the first population center downstream in Rumney, N.H.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Some data available in files of NH-Water Resources Board files.
TYPICAL SECTIONS OF DAM	Available
HYDROLOGIC/HYDRAULIC DATA	Design basis of spillway capacity available.
OUTLETS - PLAN	) Available
- DETAILS	)
- CONSTRAINTS	Not available
- DISCHARGE RATINGS	Not available
RAINFALL / RESERVOIR RECORDS	None available

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY	Some data available in NH-Water Resources Board files.
SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	None uncovered
BORROW SOURCES	Unknown
SPILLWAY PLAN - SECTIONS - DETAILS	Available

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	Available
MONITORING SYSTEMS	None
MODIFICATIONS	None, dam as it exists was rebuilt in 1954
HIGH POOL RECORDS	High pool record available for June 1942
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None uncovered
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None uncovered
MAINTENANCE OPERATION RECORDS	None uncovered

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: STINSON LAKE DAM

Drainage Area Characteristics: 7.8 square miles

Elevation Top Normal Pool (Storage Capacity): 1,303

Elevation Top Flood Control Pool (Storage Capacity): NA

Elevation Maximum Design Pool: 1,306.5

Elevation Top Dam: 1,307

SPILLWAY CREST:

a. Elevation 1,303

b. Type Ungates Concrete Ogee

c. Width NA (Ogee crest)

d. Length 100 feet

e. Location Spillover Center of dam

f. No. and Type of Gates None

OUTLET WORK:

a. Type Two 4-foot wide stop log passes 7 ft.-9 in. deep

b. Location At left abutment

c. Entrance Inverts 1,295.75 with all stop log planks removed

d. Exit Inverts 1,295.75 with all stop log planks removed

e. Emergency Draindown Facilities ______

HYDROMETEOROLOGICAL GAGES:

a. Type NA

b. Location ______

c. Records ______

MAXIMUM NON-DAMAGING DISCHARGE 3,281 cfs (combined capacity of the spillway and the two stop log passages with stop planks set to Elevation 1,303

APPENDIX B

PHOTOGRAPHS

ALL PHOTOGRAPHS TAKEN ON JUNE 5, 1978

STINSON LAKE DAM

Photo 1 - View of the dam taken from the left abutment.

Photo 2 - View of the low level outlet stop plank section on the left abutment viewed from the upstream side.

Photo 3 - View of Stinson Lake Dam taken from the upstream side.

Photo 4 - View of the rim of Stinson Lake taken from the left abutment of the dam.

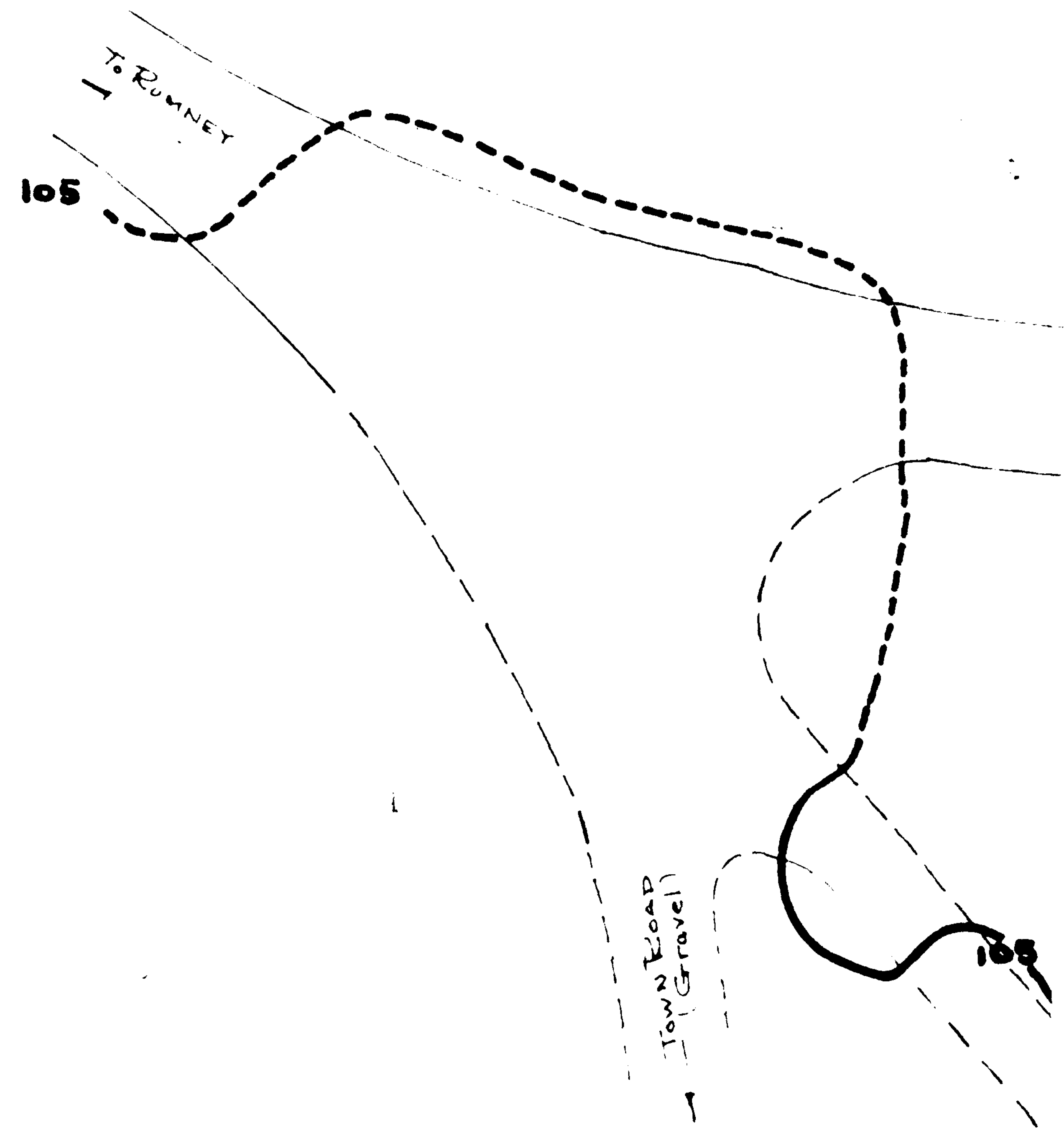
Photo 5 - View of the downstream channel from the left abutment, looking downstream.

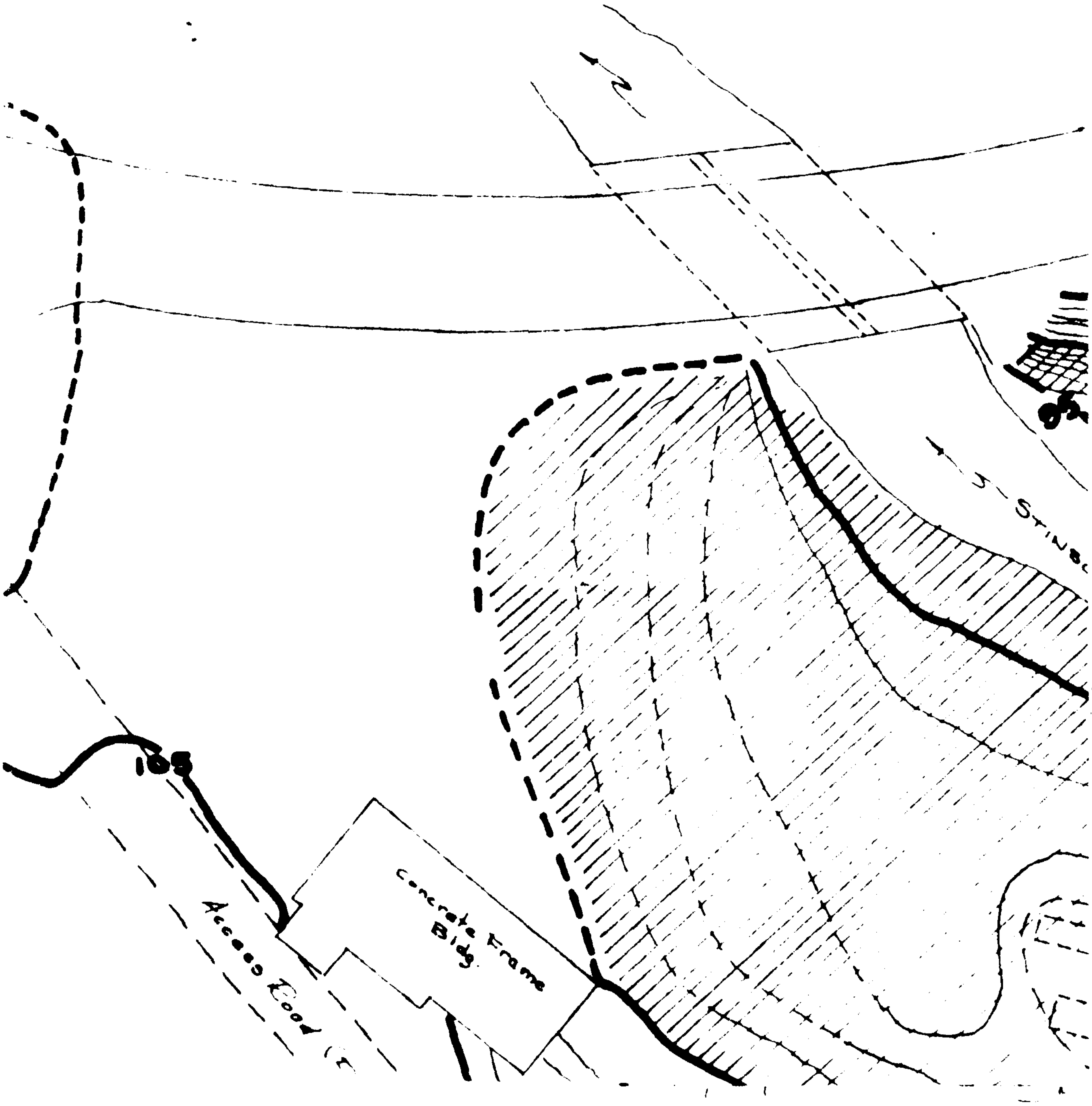
Photo 6 - View of the downstream channel from the road crossing downstream of the dam. The spillway of the dam is in the background.

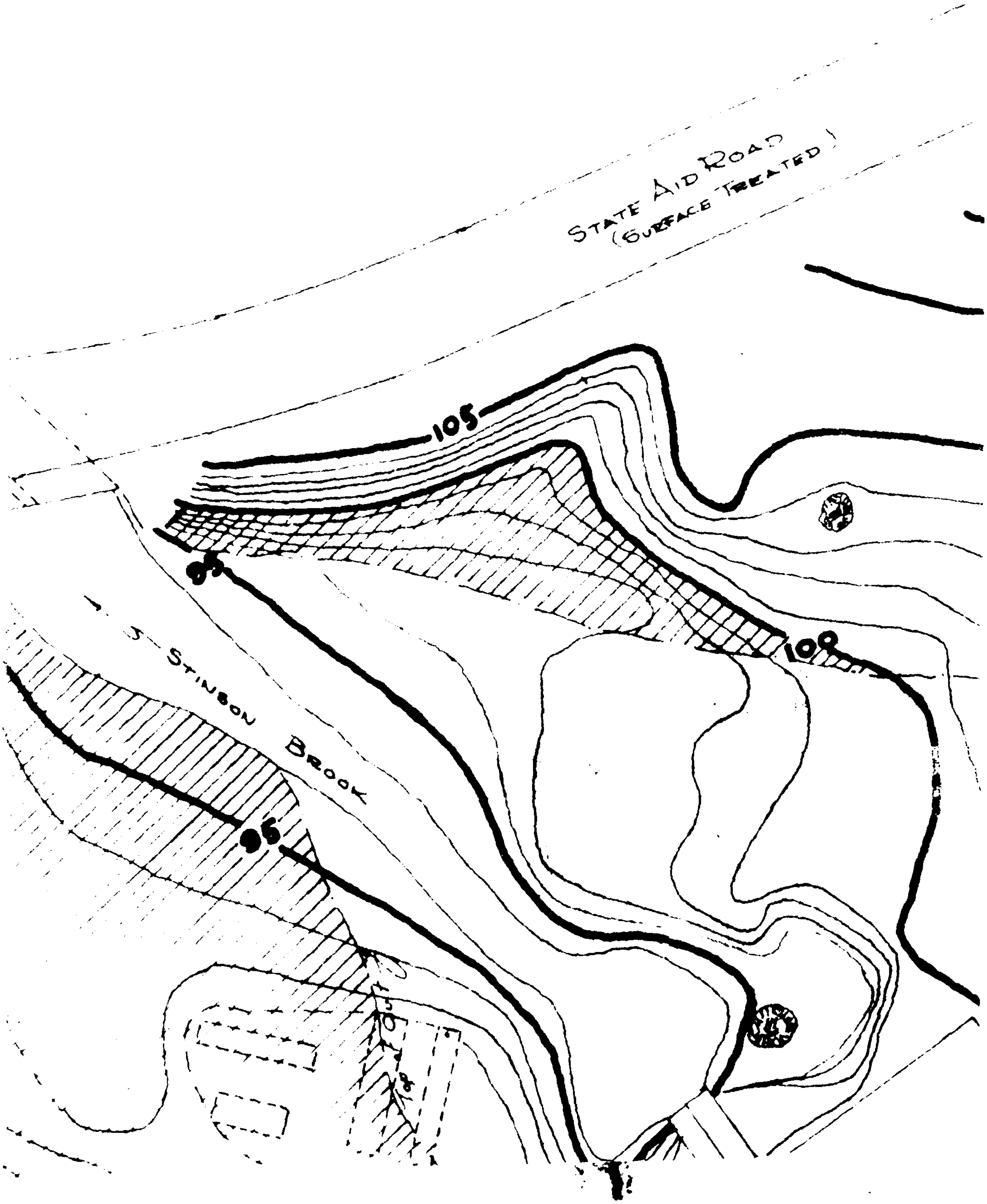
APPENDIX C

PLATES

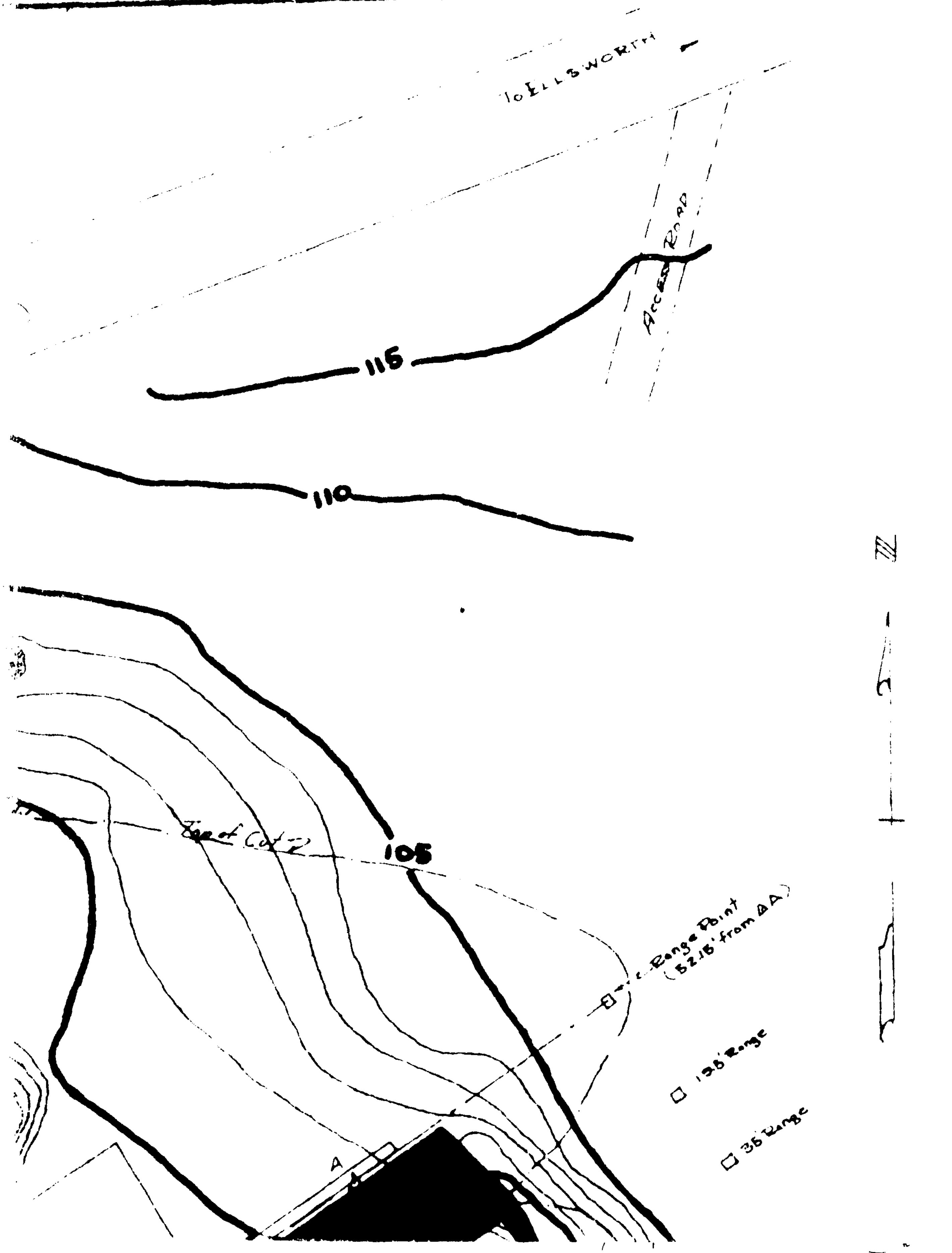
PLANS & DETAILS OF DAM	Drawings 1 & 2
GEOLOGIC MAP	Drawing 3


To Rumney
105
Town Road (Gravel)
105


105
Concrete Frame Bldg
Access Road



STATE AID ROAD
(SURFACE TREATED)
105
95
100
STINSON BROOK
95



To ELLSWORTH
Access Road
115
110
105
Top of Cut
Range Point (52.18' from AA)
158' Range
35' Range
A

REVISIONS

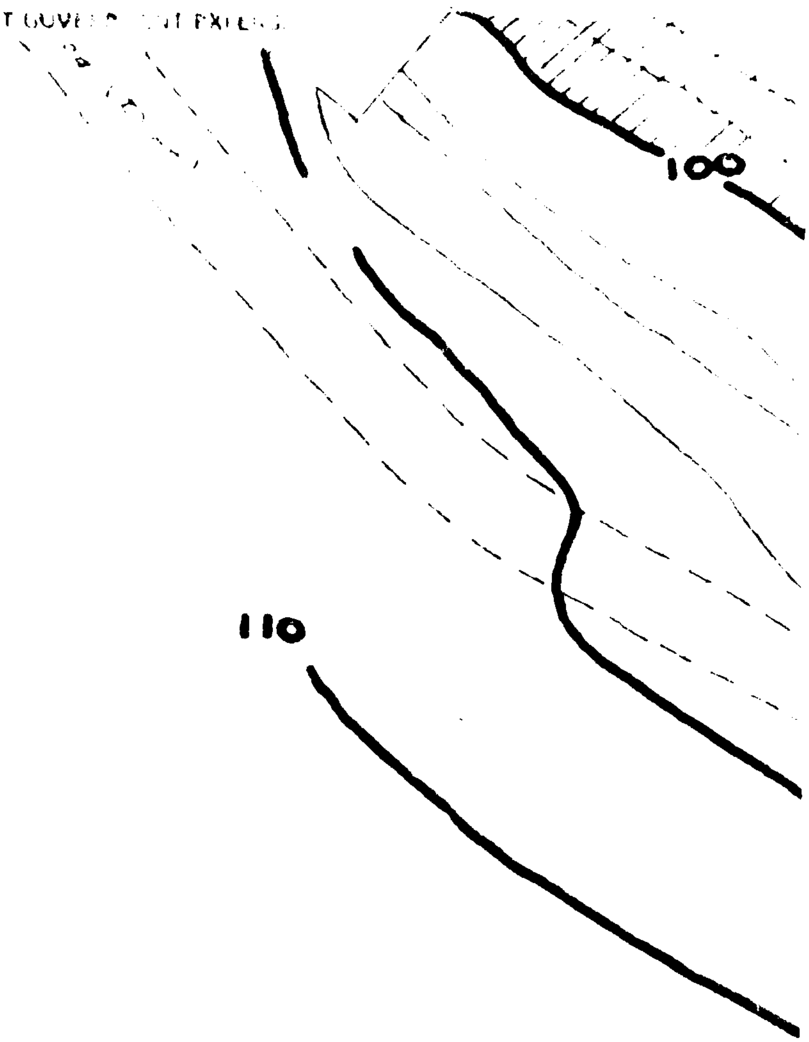
DATE

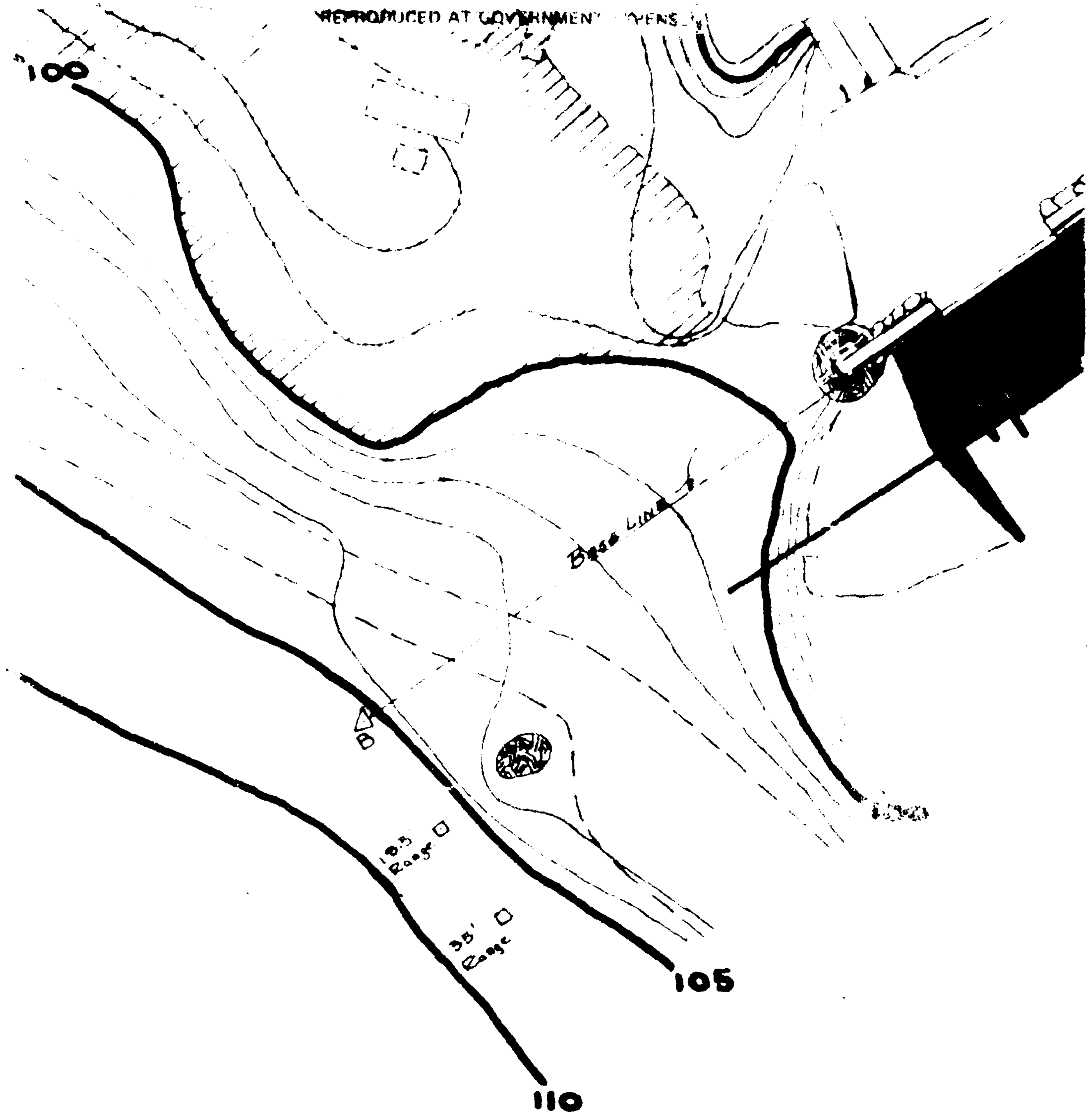
Designed by

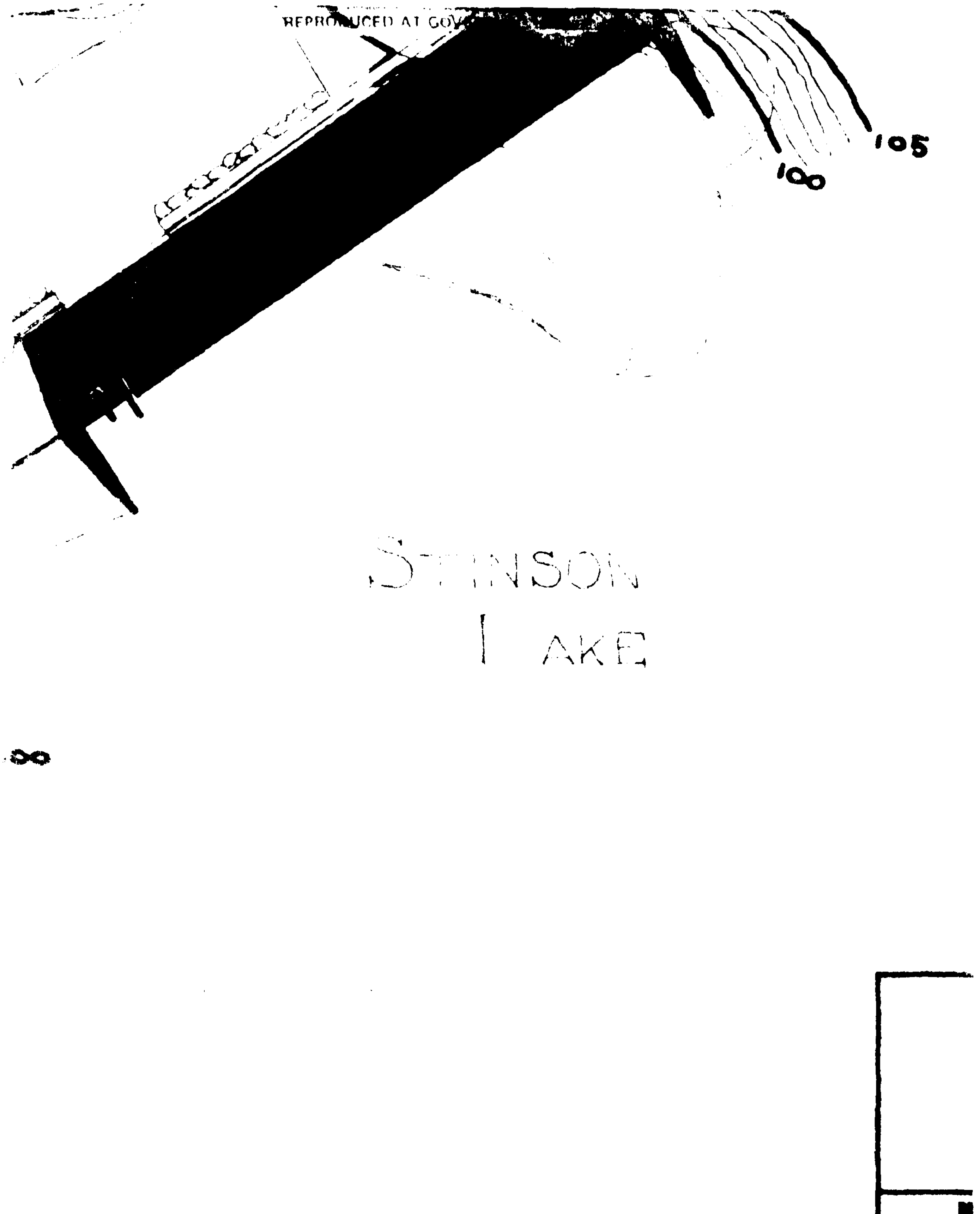
Drawn by F.C.M

Traced by H.A.S

Checked by


100
110


100
Base Line
B
Range
35' Range
105
110


105
100
STINSON
LAKE
Scale

105

DWG. #1

Spoil Areas

Construction Area

Note B.M #1 = EL. 100.00', located at upstream Concrete Corner of opening in fish screen dam at N.W. End

TOPOGRAPHY AT STINSON LAKE

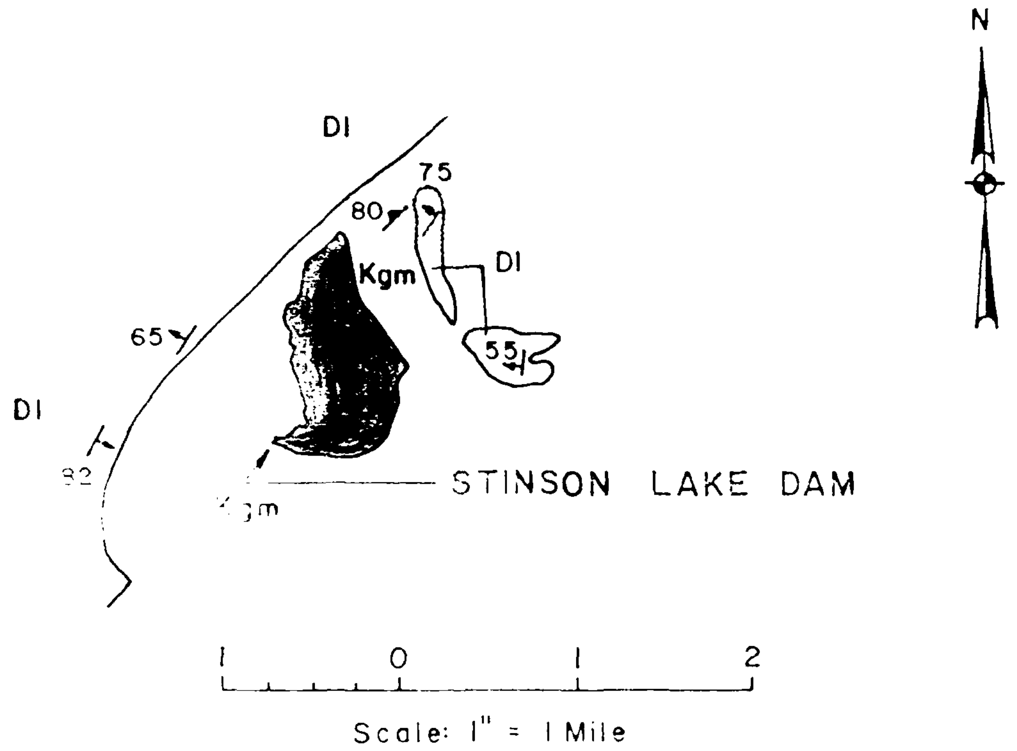
SHOWING LOCATION OF CONCRETE DAM

RUMNEY, N.H.

NEW HAMPSHIRE WATER RESOURCES BOARD

- CONCORD, N. H. -

Scale 1" = 20'	*Jan/Aug 1954*	*207.01*



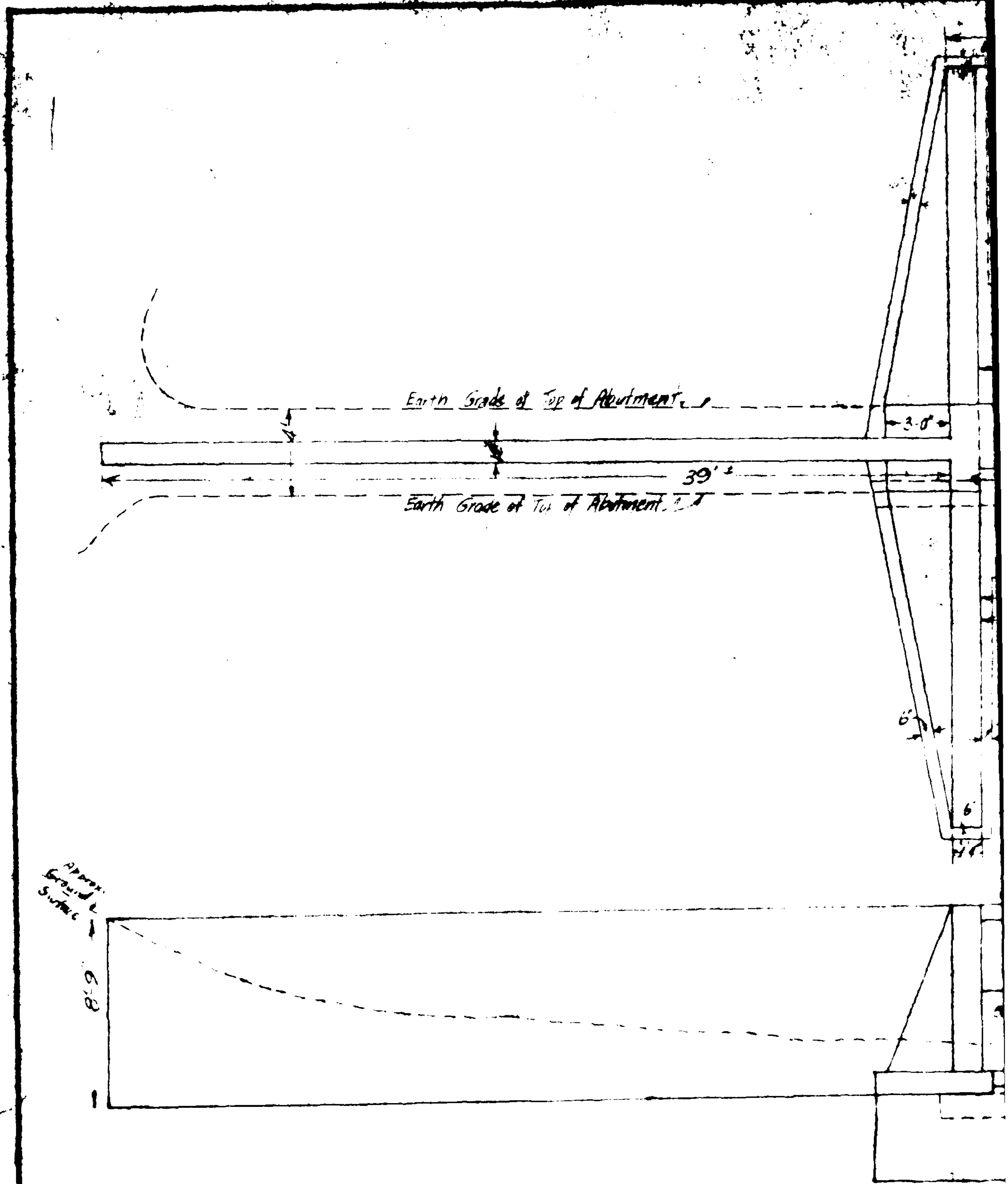
LEGEND:

Kgm	Quartz Monzonite, Medium-to Coarse-Grained
DI	Quartz-Garnet-Mica Schist
82	Strike and Dip of Bedding
80	Strike and Dip of Foliation
	Contact

NOTES: 1. Outcrops absent at Dam and in Reservoir
2. Surface Mantled by Ground Moraine

GEOLOGIC MAP
STINSON LAKE DAM

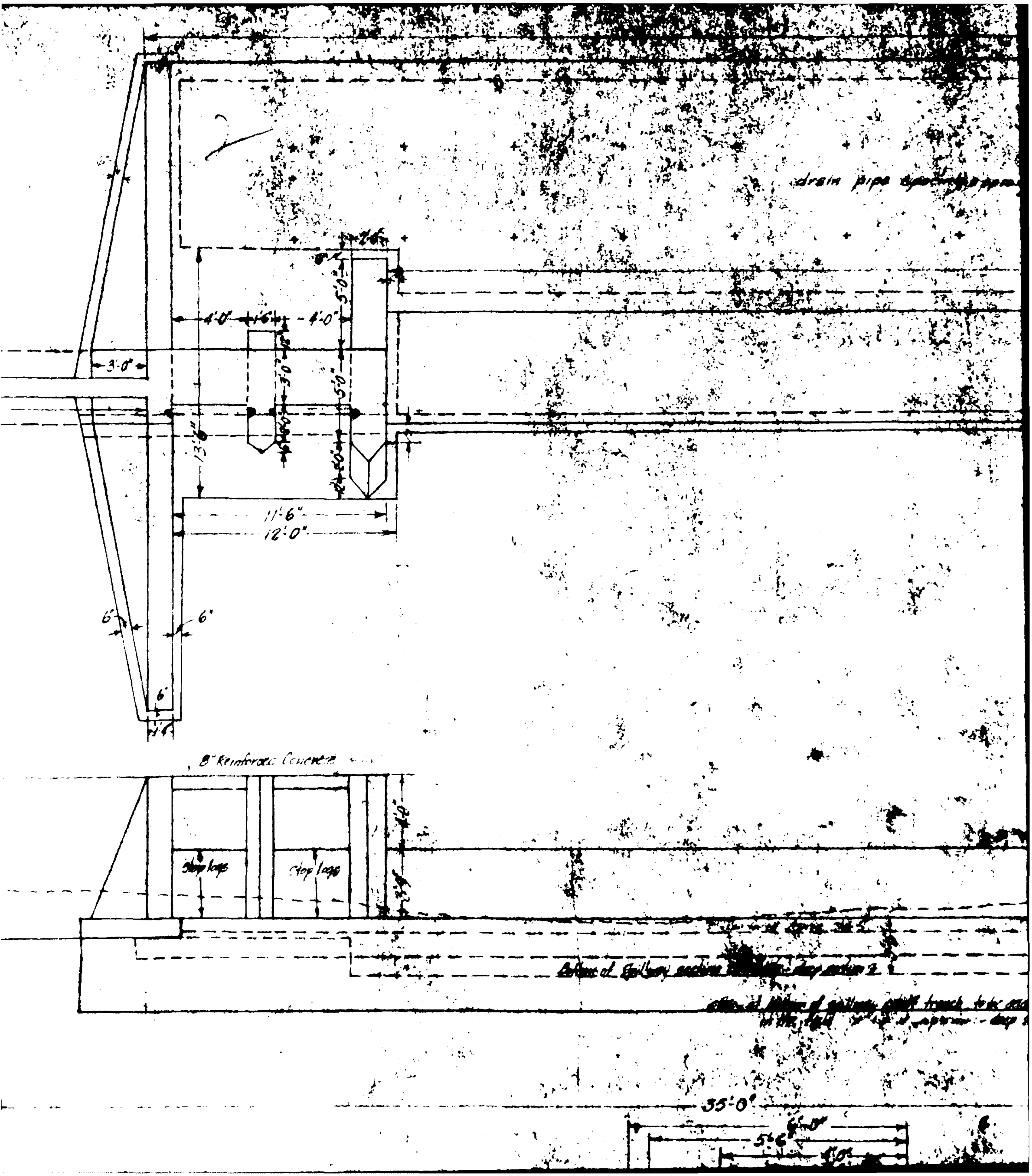
DWG. NO. 3

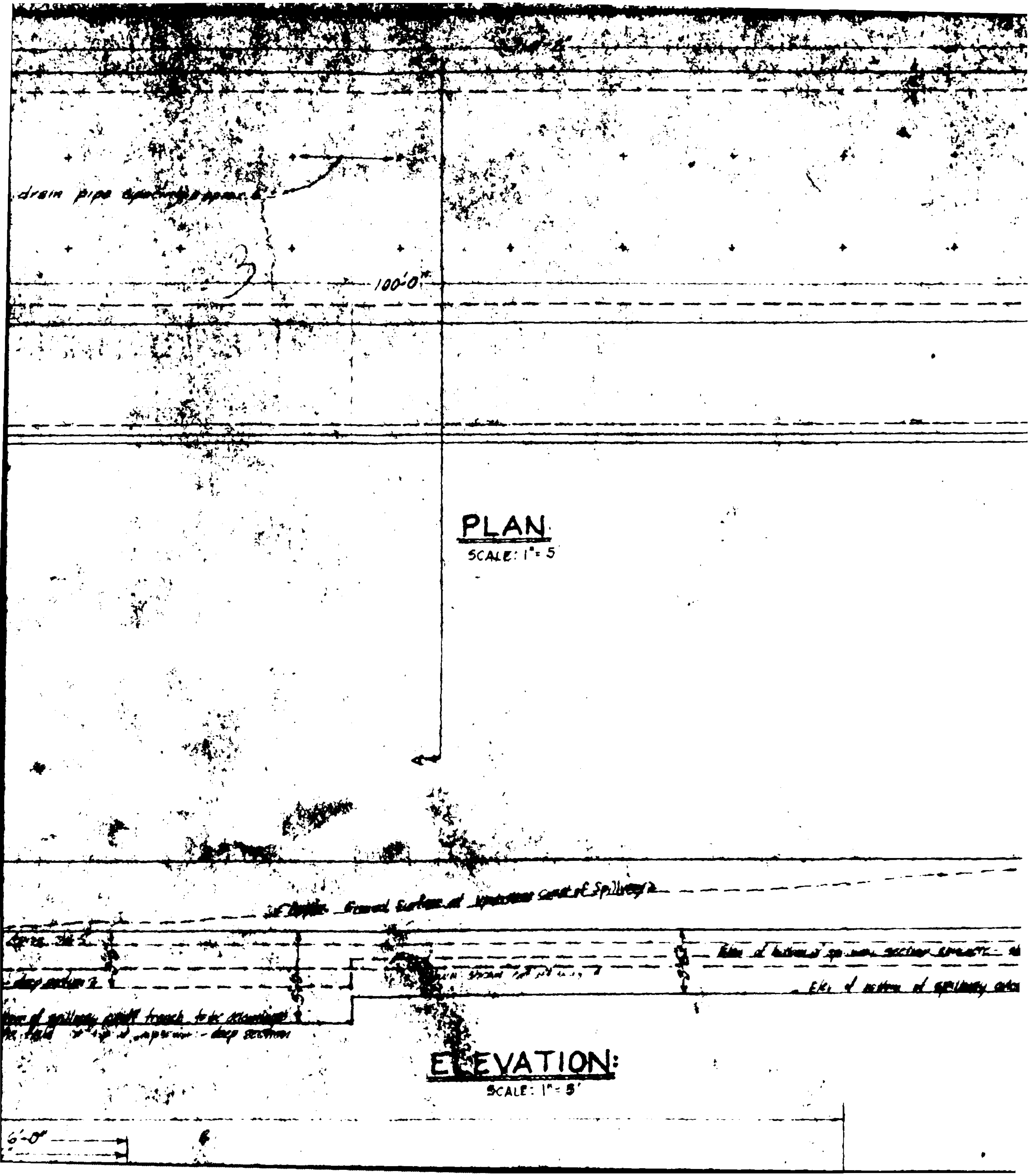


SPILLWAY CURVE DATA:

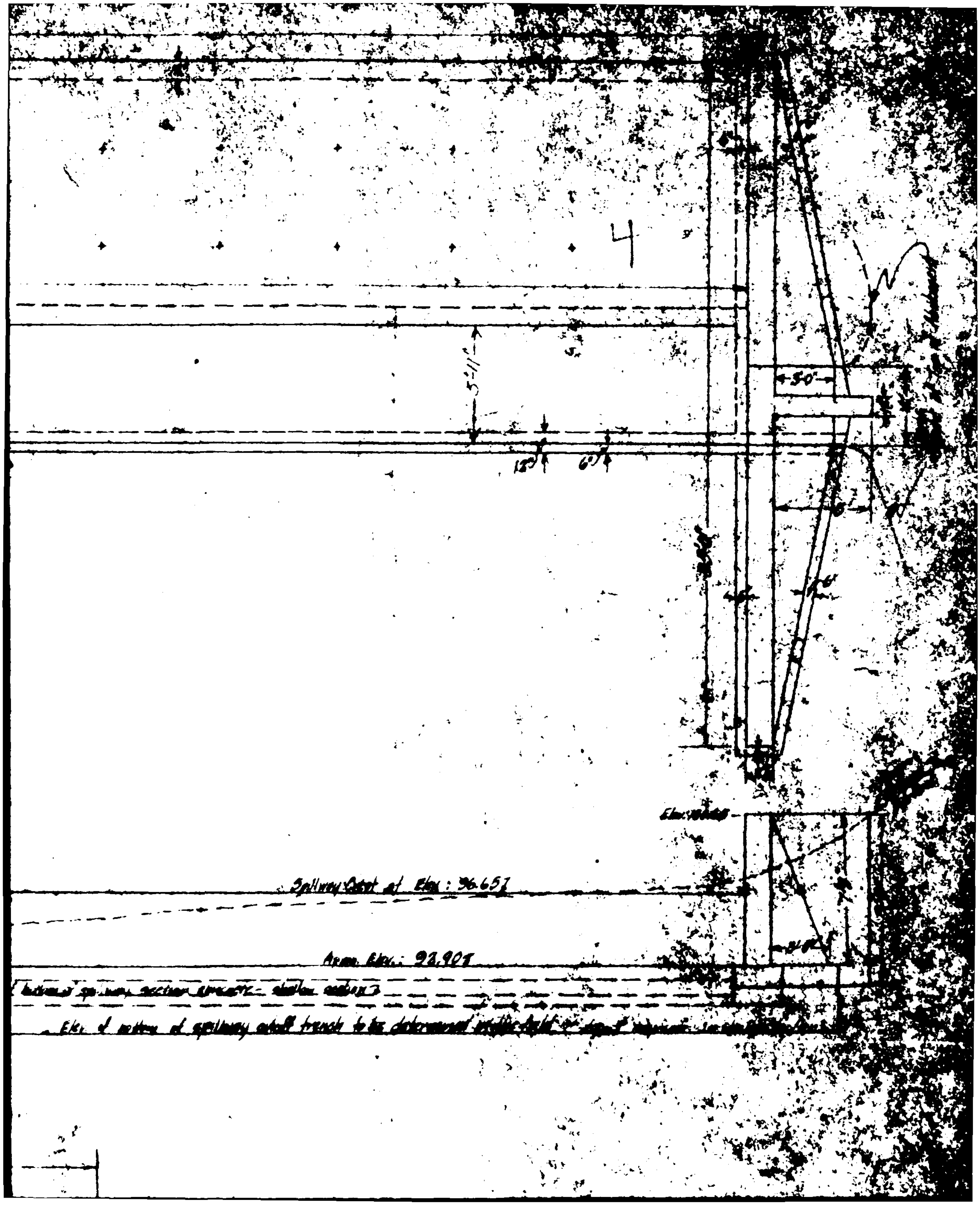
Feet from "0" (Hemo - 2.73')

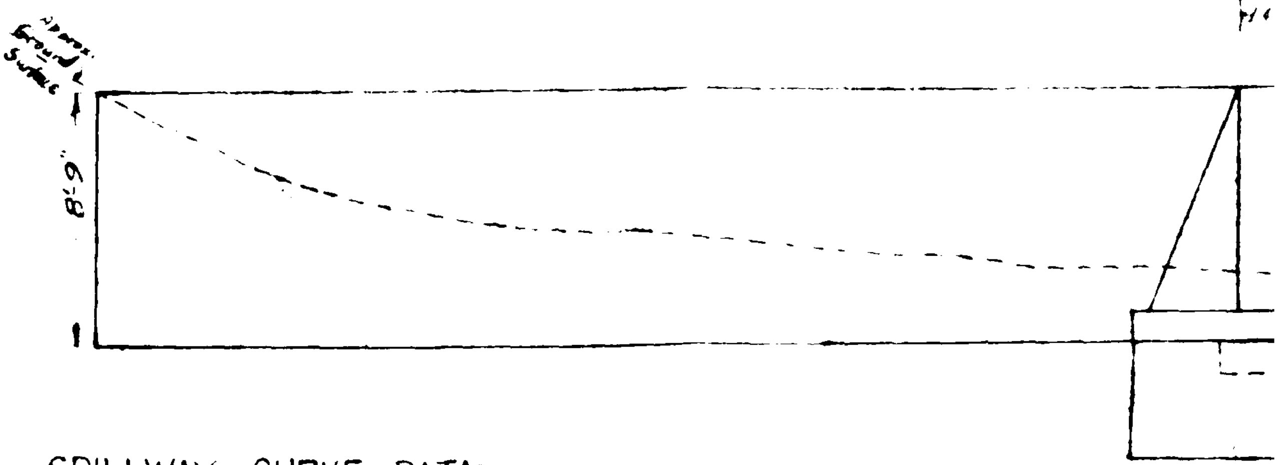
Right	Down
0.00	0.29
0.29	0.00
0.82	0.00
1.10	0.03
1.50	0.15


drain pipe
4'0"
1'6"
4'0"
3'0"
5'0"
3'0"
13'6"
11'6"
12'0"
6"
6"
6"
8" Reinforced Concrete
Stop logs
Stop logs
35'0"



100'0"
PLAN
SCALE: 1"= 5
ELEVATION:
SCALE: 1"= 5'
6'-0"

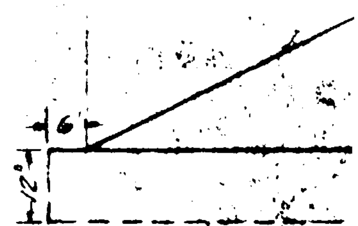

4
5'-11"
12"
6"
5'-0"
Spillway Crest at Elev.: 96.65±
Apron Elev.: 92.90±



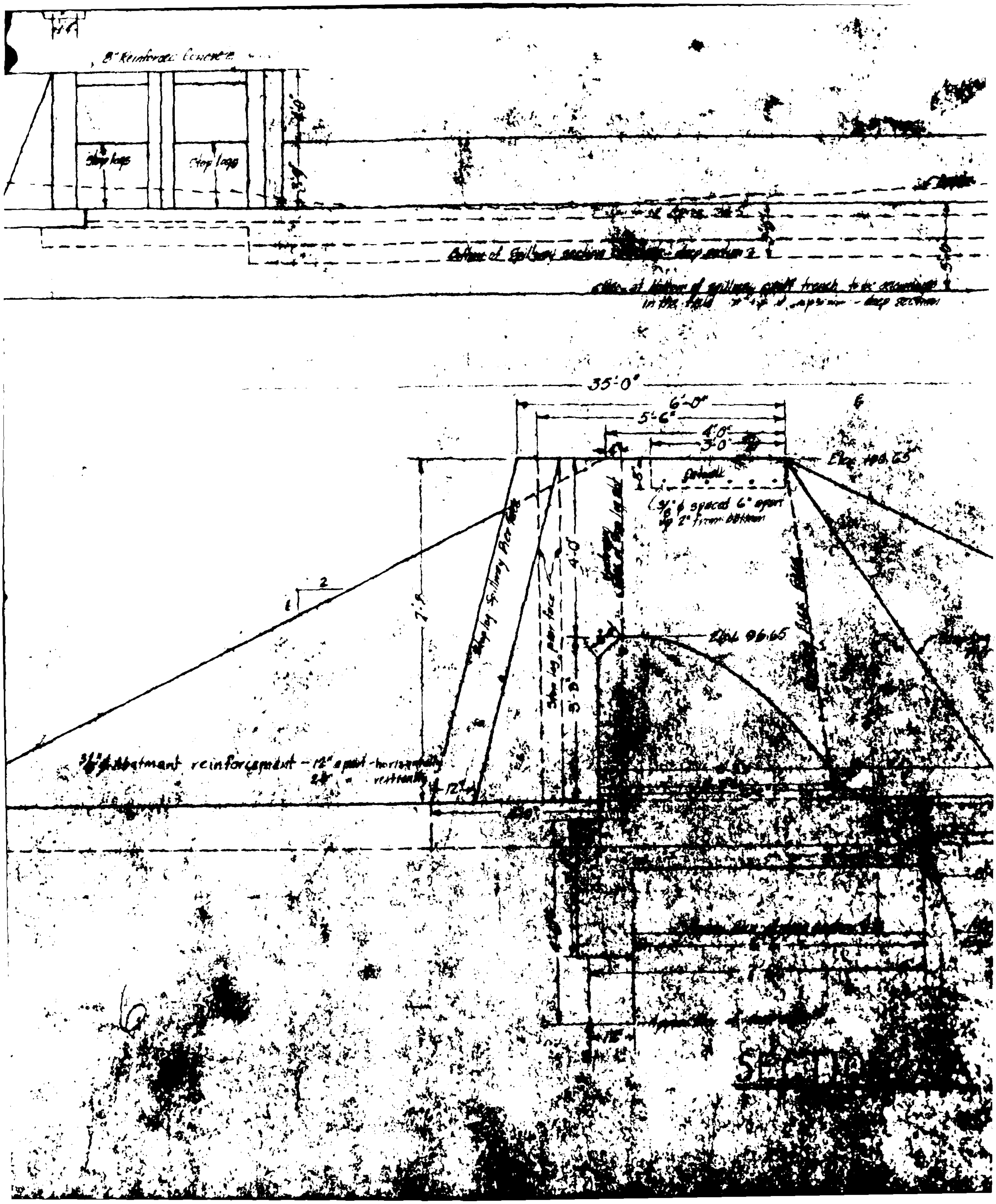
SPILLWAY CURVE DATA:

Feet from "0" (Hemo - 2.75')

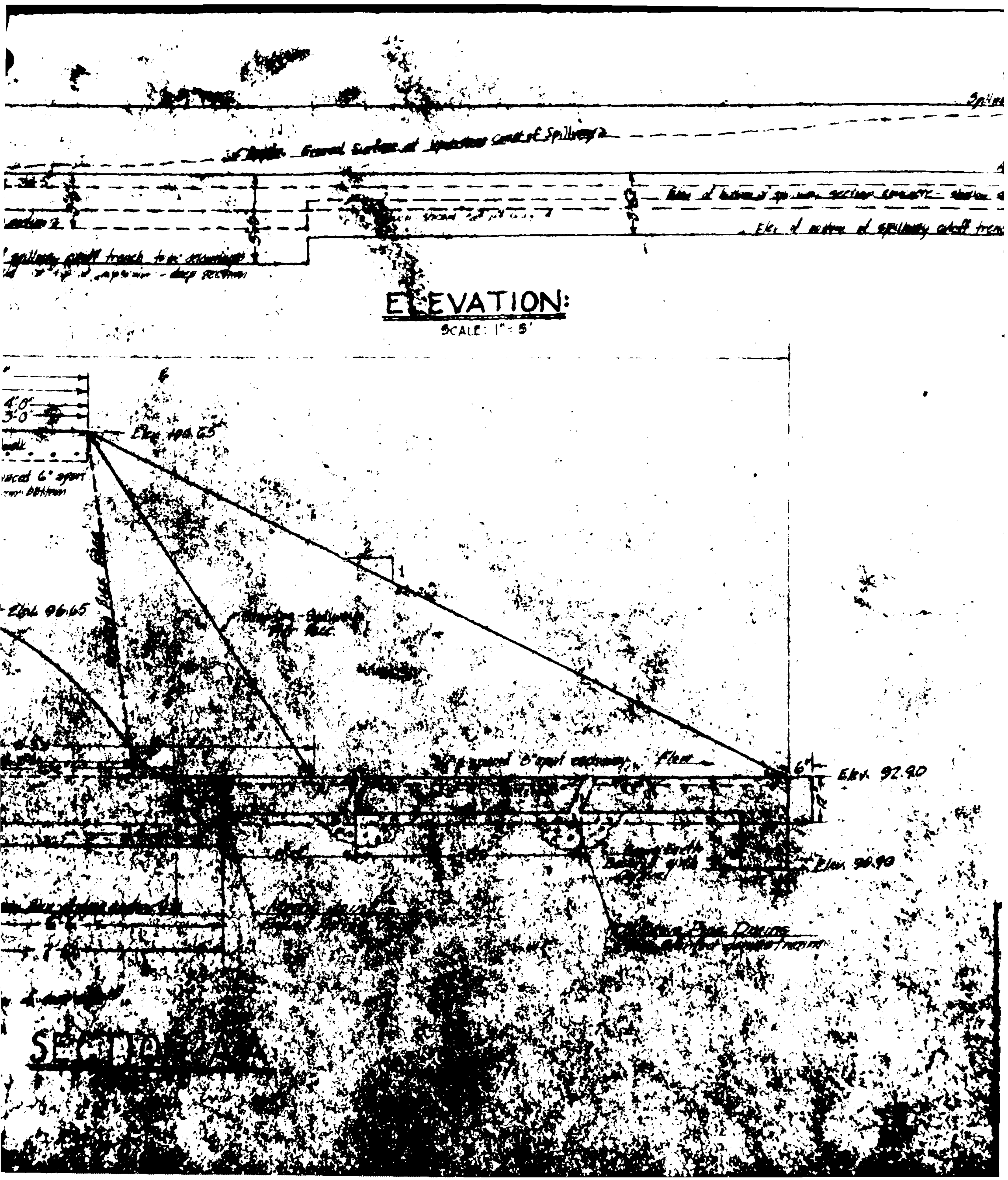
Right	Down
0.00	0.29
0.29	0.00
0.82	0.00
1.10	0.03
1.50	0.15
1.94	0.33
2.23	0.45
2.50	0.60
2.89	0.88
3.24	1.18
3.61	1.50
3.94	1.84
4.26	2.19
4.42	2.57
4.86	2.95
5.13	3.33
5.31	3.52
5.49	3.64
5.71	4.72
5.95	4.75

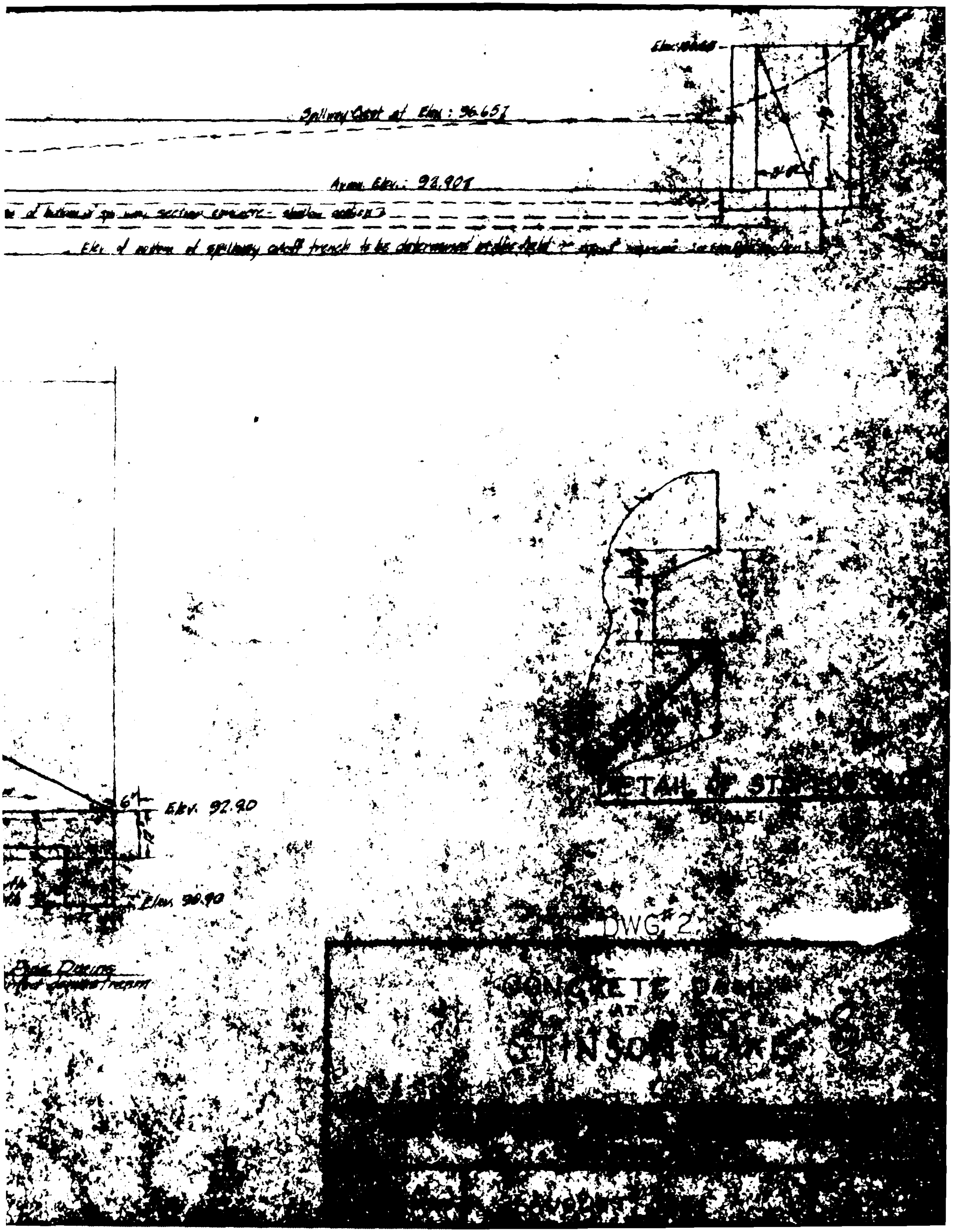


Designed by F.C.M.
Drawn by F.C.M.
Traced by F.C.M.
Checked by



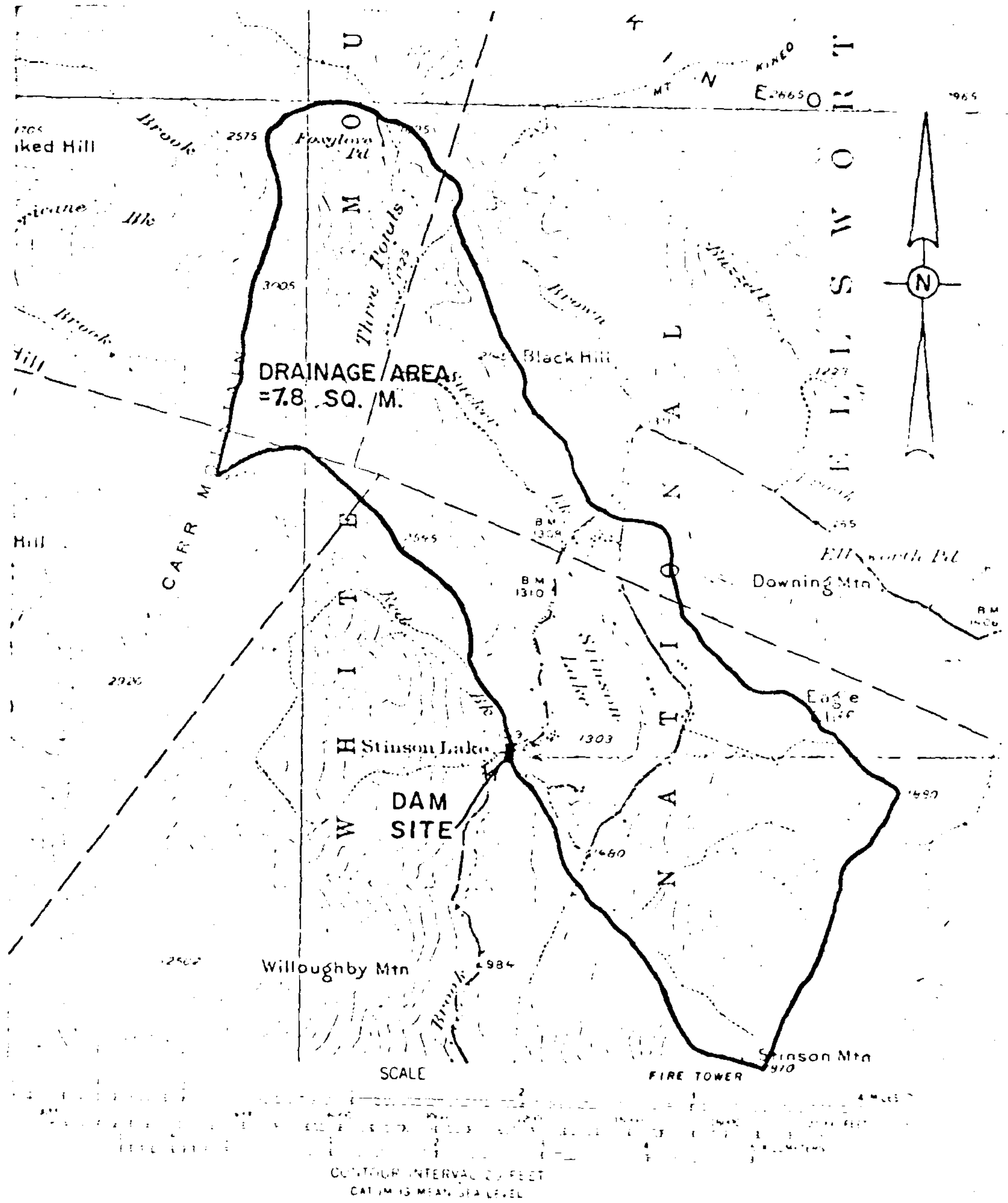
8" Reinforced Concrete
Stop logs
Stop logs
35'-0"
6'-0"
5'-6"
4'-0"
3'-0"
3/8" ϕ spaced 6" apart up 2" from bottom
7'-0"
4'-0"
3'-0"
2
1
Elev. 96.65
3/8" ϕ Abutment reinforcement - 12" apart - horizontally 24" " vertically
12"


ELEVATION:
SCALE: 1" = 5'
Ground Surface at upstream crest of Spillway 2
4'0"
3'0"
Elev. 100.65
placed 6" apart
Elev. 96.65
Elev. 92.90
Elev. 90.90


Spillway Crest at Elev.: 96.65
Apron Elev.: 92.90
Elev. 92.90
Elev. 90.90
DWG # 2

APPENDIX D

HYDROLOGIC COMPUTATIONS



STINSON LAKE DAM
DRAINAGE BASIN

SHEET NO. 2 OF

JOB NO.

BY DATE

[illegible]

9", according to [illegible]

= 13.27 hours

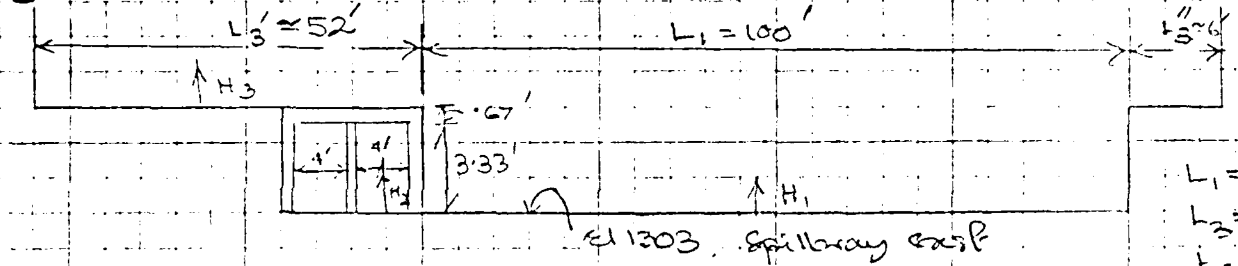
T = 13.27 hours

ECI-4 ENGINEERING CONSULTANTS, INC. 3

NEW HAMPSHIRE DAM SAFETY INSPECTION — SHEET NO. 13 OF

STINSON LAKE DAM — JOB NO. 1211-001

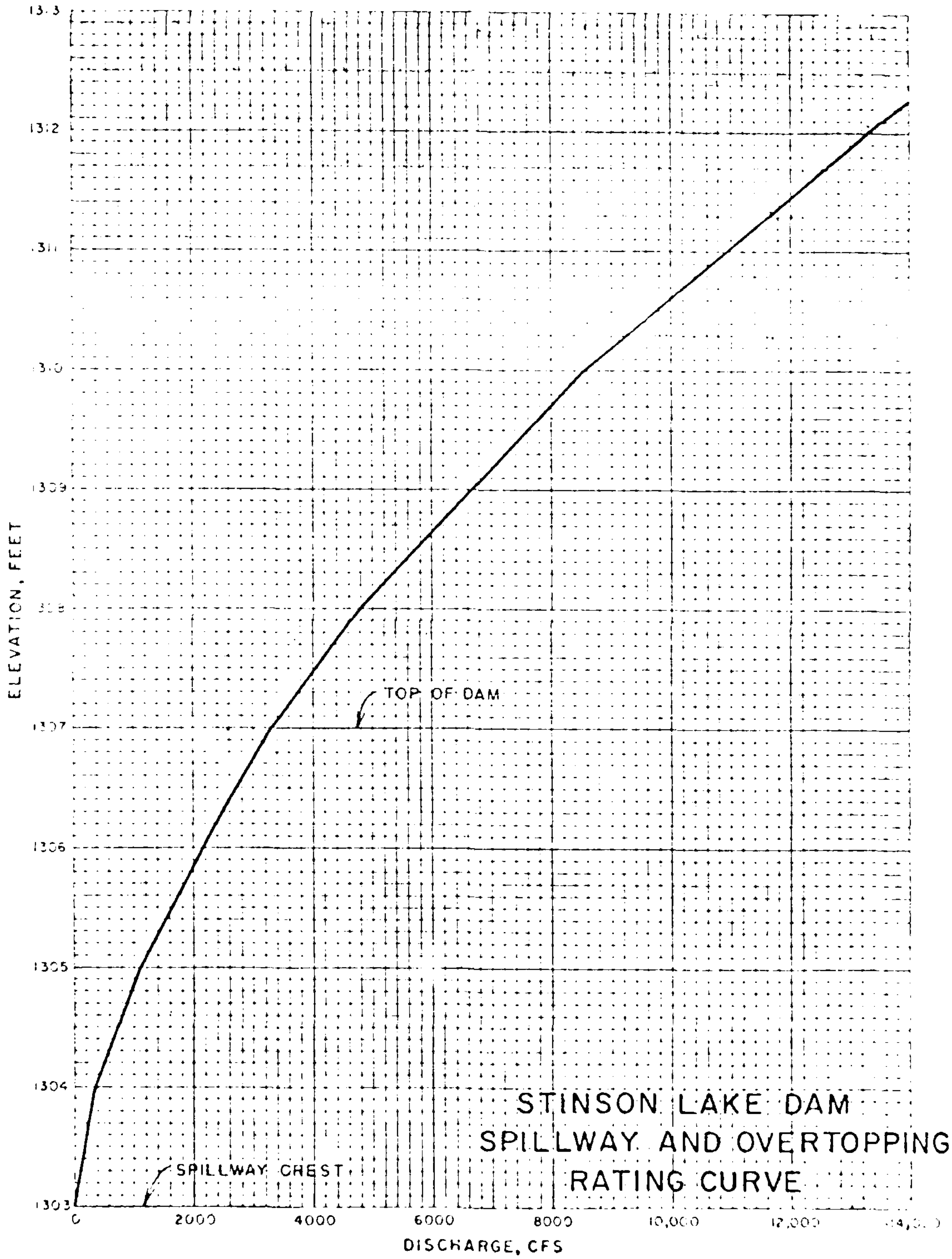
SPILLWAY & OVERTOPPING RATING CURVE — BY MAS — DATE 6-7?

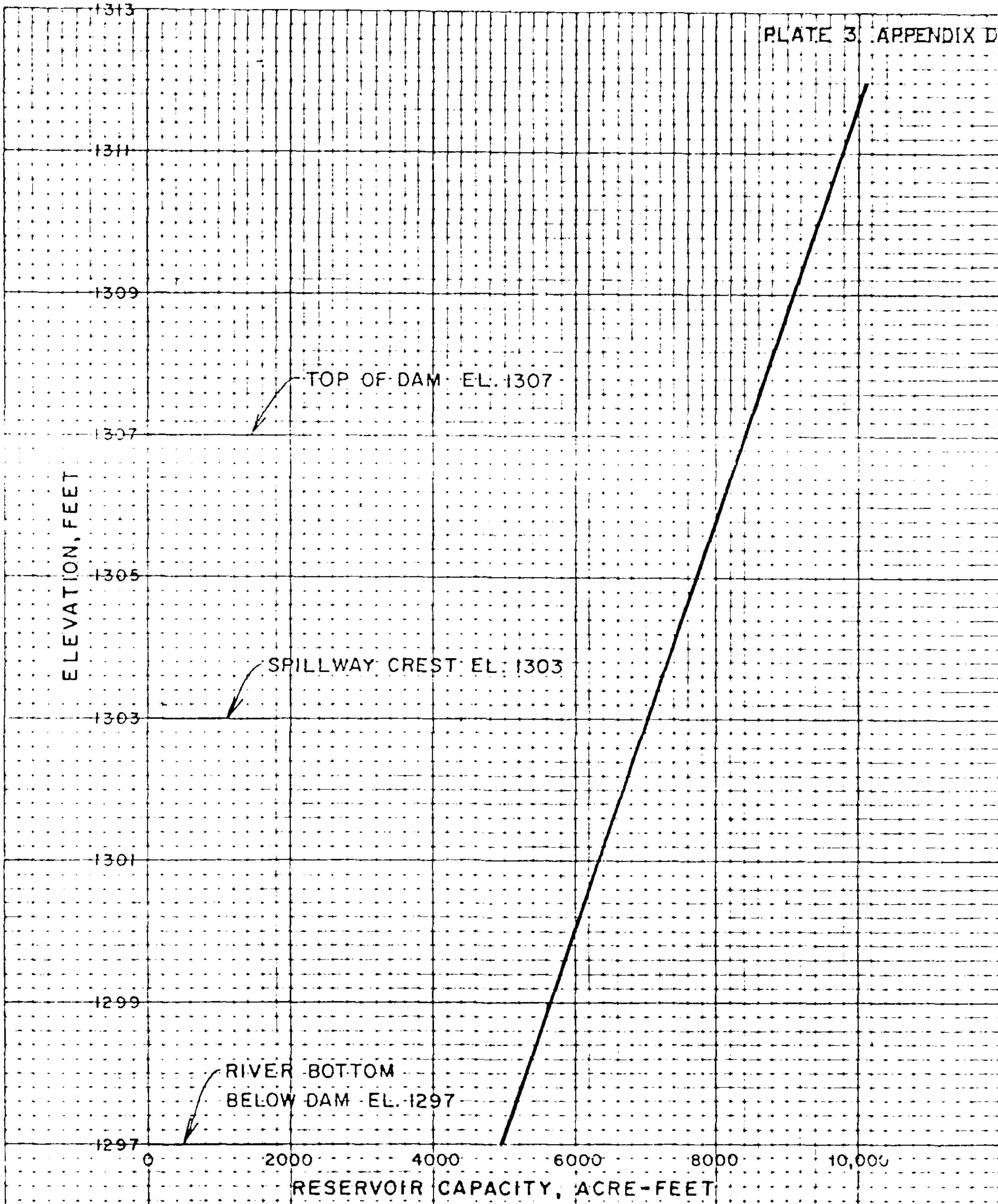


$L_1 = 100'$
$L_3 = L_3' + L_3'' = 58'$
$L_2 = 4' + 4' = 8'$

Elev.	H_1	H_2		H_3	L_1	L_2	L_3	C_1	C_2	C_3	$Q = C_1L_1H_1^{1.5} + C_2L_2H_2^{1.5} + C_3L_3H_3^{1.5}$ upto $H_2 = 3.33'$ Beyond $H_2 = 3.33'$ use orifice eqn for section 2. $Q = C_1L_1H_1^{1.5} + \frac{2}{3}\sqrt{2g}\,C_2'L(H_2^{1.5} - H_2'^{1.5}) + C_3L_3H_3^{1.5}$
303	0	0		0	/	/	/	0	0	0	
1304	1	1		/	100	8'		3.55	3.2		355 + 26 + 0 = 381. cfs
1305	2	2		/	100	8		3.75	3.4		1061 + 77 + 0 = 1138 cfs
1306.33	3.33	3.33		/	100	8		3.85	3.6		2340 + 175 + 0 = 2515 cfs
		H_2	H_2'						C_2'		
1307	4'	4'	.67	/	100	8'		3.85	0.63		3080 + 201 + 0 = 3281 cfs
1308	5'	5	1.67	1	100	8	59	3.85	0.65	3.2	4304 + 251 + 189 = 4744 cfs
1310	7'	7	3.67	3	100	8	59	3.85	0.67	3.6	7130 + 330 + 1104 = 8564 cfs
1312	9'	9	5.67	5	100	8	59	3.85	0.68	3.8	10395 + 333 + 2507 = 13235 cfs
1313	10'	10	6.67	6	100	8	59	3.85	0.68	3.8	12175 + 419 + 3295 = 15889 cfs

PLATE 2 APPENDIX D





STINSON LAKE DAM
RESERVOIR CAPACITY CURVE

DAM FAILURE SURGE STUDY

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 1 OF

STINSON LAKE DAM JOB NO. 1211-001-1

DAM FAILURE STUDY (REVISED) BY KLB DATE 8-2-

STINSON LAKE DAM

EFFECT OF DAM FAILURE

STEP 1: DETERMINE PEAK FAILURE OUTFLOW, Q_{p1}

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g}\, Y_o^{3/2}$$

Q_{p1} = FAILURE OUTFLOW IN CFS

W_b = 40% OF DAM LENGTH ACROSS RIVER AT MIDHEIGHT AT PMF

Y_o = TOTAL HEIGHT FROM RIVER BED TO TOP OF DAM

Y_o = (1307 - 1297) ≃ 10 FT

(1307 = TOP OF DAM; 1297 = RIVER BED)

DAM LENGTH AT MIDHEIGHT ≃ 146 FT (FROM DRAWING)

$\therefore W_b = 0.40 \times 146 = 58.4$ Ft

$$Q_{p1} = \frac{8}{27} (58.4) \sqrt{64.4}\, (10.0)^{3/2}$$

$$= \underline{4391 \text{ CFS}}$$

EC:-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY — SHEET NO. __ OF __
STINSON LAKE DAM — JOB NO. 1211 2021
DAM FAILURE STUDY (REVISED) — BY KLB — DATE 8-2-

STEP 2: DEVELOP STAGE DISCHARGE CURVES FOR THE DOWNSTREAM CHANNEL AT THE END OF EACH REACH, ASSUMING UNIFORM FLOW AND MANNINGS n = 0.10

THE STAGE DISCHARGE CURVES FOR STINSON BROOK ARE ON PAGES 3 THROUGH 6

STEP 3: DETERMINE STAGE CORRESPONDING TO Q_{P1} AT EACH SECTION ASSUMING THE STAGE-DISCHARGE CURVES ARE VALID FOR UNSTEADY FLOW CASE:

PEAK DISCHARGE = 4371 CFS

DISTANCE FROM DAM, MILES	0	1	2	3.3
STAGE (FEET)	7.9	8.8	7.5	8.6

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 1 OF
STINSON LAKE DAM JOB NO. 1211-001
RATING CURVE FOR D/S CHANNEL BY MAS DATE 6-27

Immediately Below Damsite

Assume Mannings 'n' = 0.10
Approximate channel slope, S
= 0.0379 ft/ft (from U.S.G.S topo map)

$Q = \frac{1.49}{n} AR^{2/3}S^{1/2} = 2.9AR^{2/3}$

Stage (ft)	Area, A (sf.)	Wetted perimeter P (ft.)	Hydraulic radius R (ft.)	$AR^{2/3}$	$Q = 2.9AR^{2/3}$ cfs
0	0	0	0	0	0
4	150	75	2	239	639
8	600	150	4	1519	4405
12	1320	220	6	4,385	12,717

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. OF
STINSON LAKE DAM JOB NO. 1211-001
RATING CURVE FOR D/S CHANNEL BY JMS DATE 6-27-

1- Mile Below Damsite

Assume Mannings 'n' = 0.10

Approximate channel slope, s

= 0.0473 ft/ft (from USGS Topo map)

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = 3.24\, AR^{2/3}$$

Stage ft	Area A ft²	Wetted perimeter P ft	Hydraulic Radius R ft	$AR^{2/3}$	$Q = \frac{1.49}{n} AR^{2/3} = 3.24\, AR^{2/3}$
0	0	0	0	0	0
4	100	50	2	159	515
8	408	102	4	1028	3,331
12	960	160	6	3170	10,278

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. OF
STINSON LAKE DAM JOB NO. 1211-001
RATING CURVE FOR D/S CHANNEL BY MAE DATE 6-27

Two Miles Below Damsite

Assume Mannings 'n' = 0.10

Approximate Channel Slope, S

= 0.0492 ft/ft (From USGS 7.5 min)

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = 3.305 AR^{2/3}$$

Stage (ft.)	Area, A (sq.ft.)	Wetted perimeter P (ft.)	Hydraulic radius R (ft.)	$AR^{2/3}$	$Q = 3.305 AR^{2/3}$ (cfs)
0	0	0	0	0	0
4	140	70	2	223	736
8	600	150	4	1519	5020
12	1380	230	6	4584	15150

ECI-4 ENGINEERING CONSULTANTS, INC.

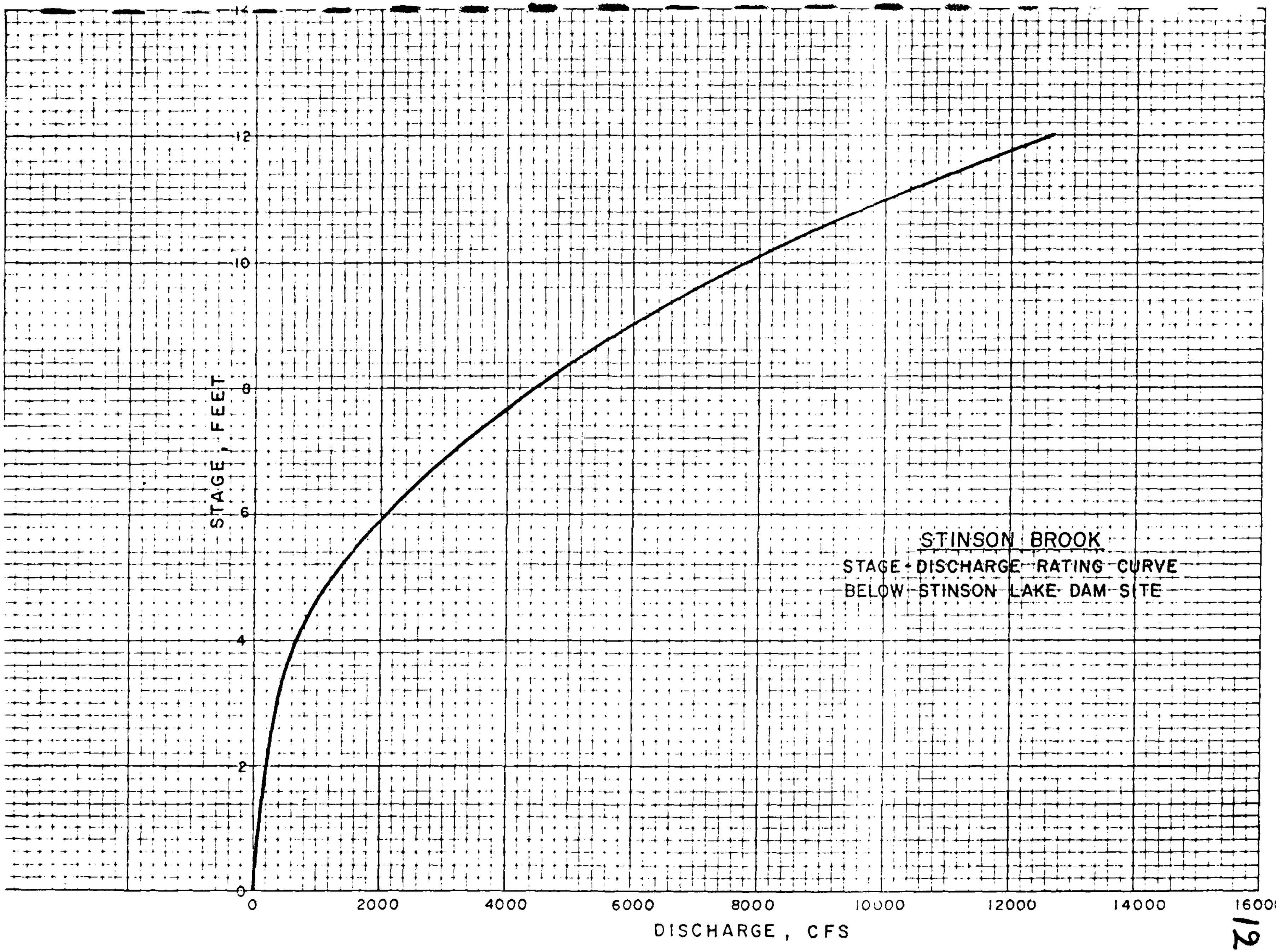
NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. ___ OF ___
STINSON LAKE DAM JOB NO. 1211-071
RATING CURVE FOR D/S CHANNEL BY MAS DATE 6-27

3.3 Miles Below Damsite

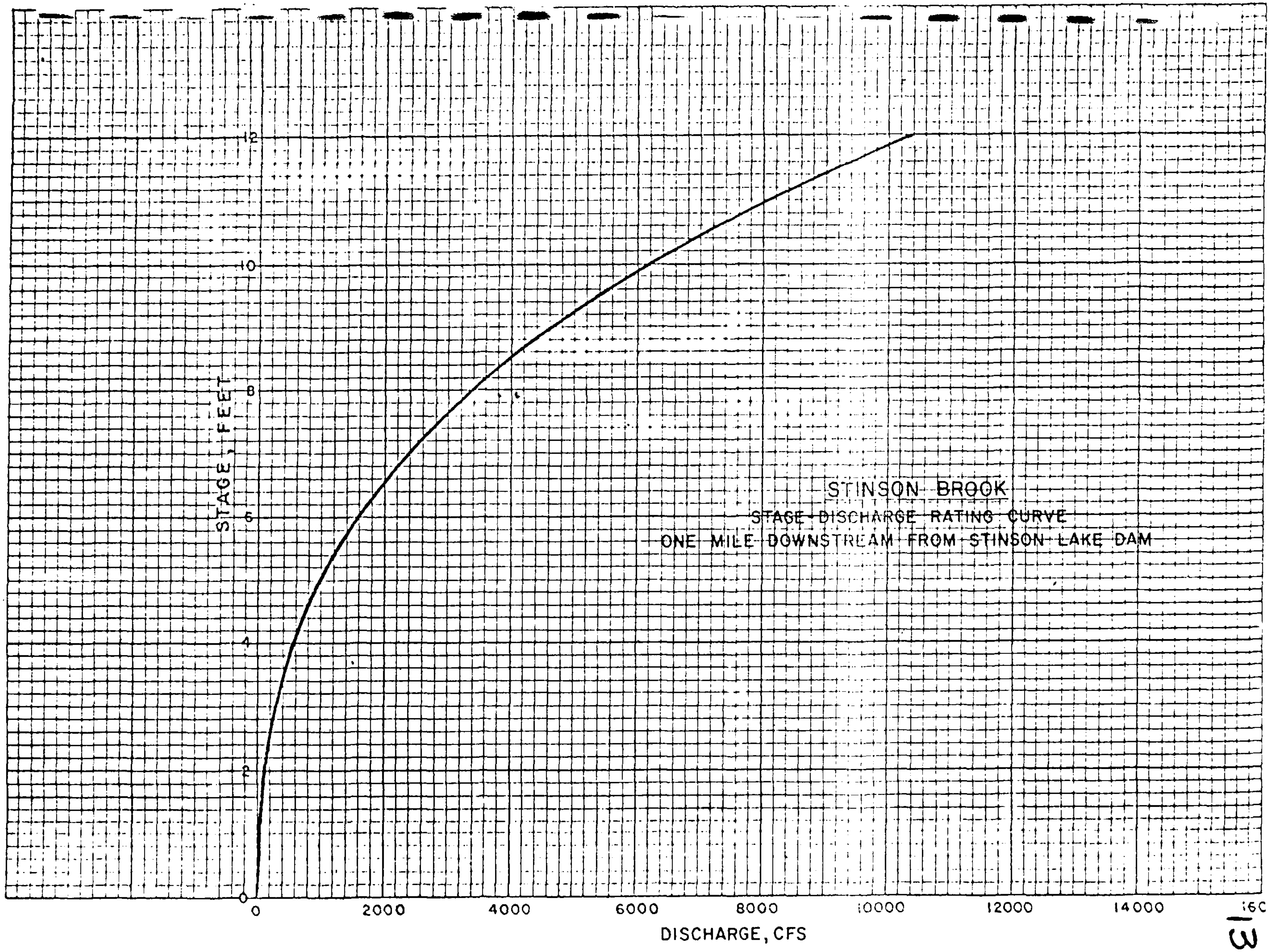
Assume Mannings 'n' = 0.10
Approximate Channel Slope, S
= 0.0095 ft/ft (from USGS Topo maps)

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} = 1.45 A R^{2/3}$$

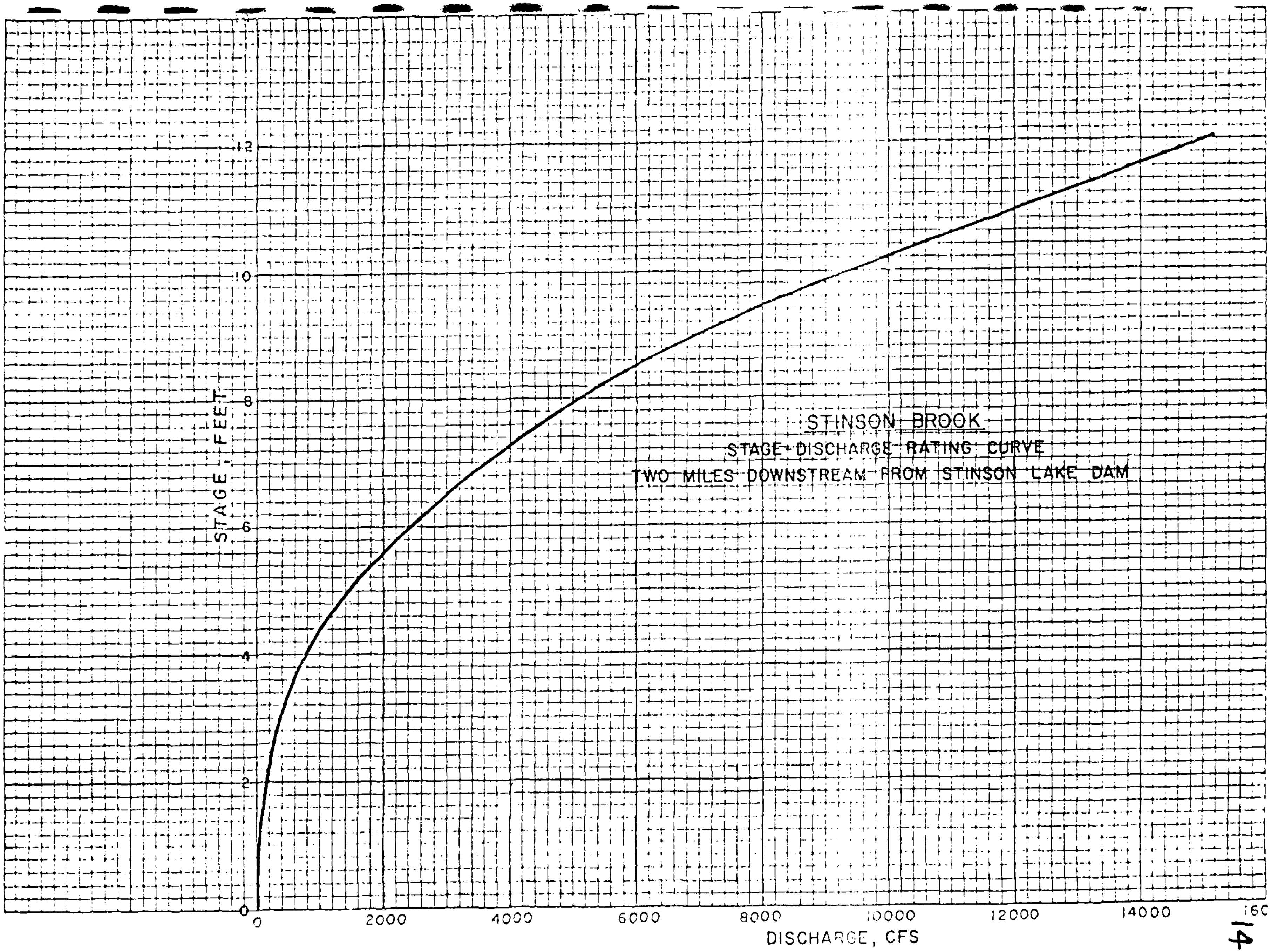
Stage (ft.)	Area A (sq.ft.)	Wetted perimeter P (ft.)	Hydraulic radius R (ft.)	$AR^{2/3}$	$Q = 1.45AR^{2/3}$ (cfs.)
0	0	0	0	0	0
4	240	120	2	381	552
8	1000	250	4	2532	3671
12	2291	380	6	6681	9687

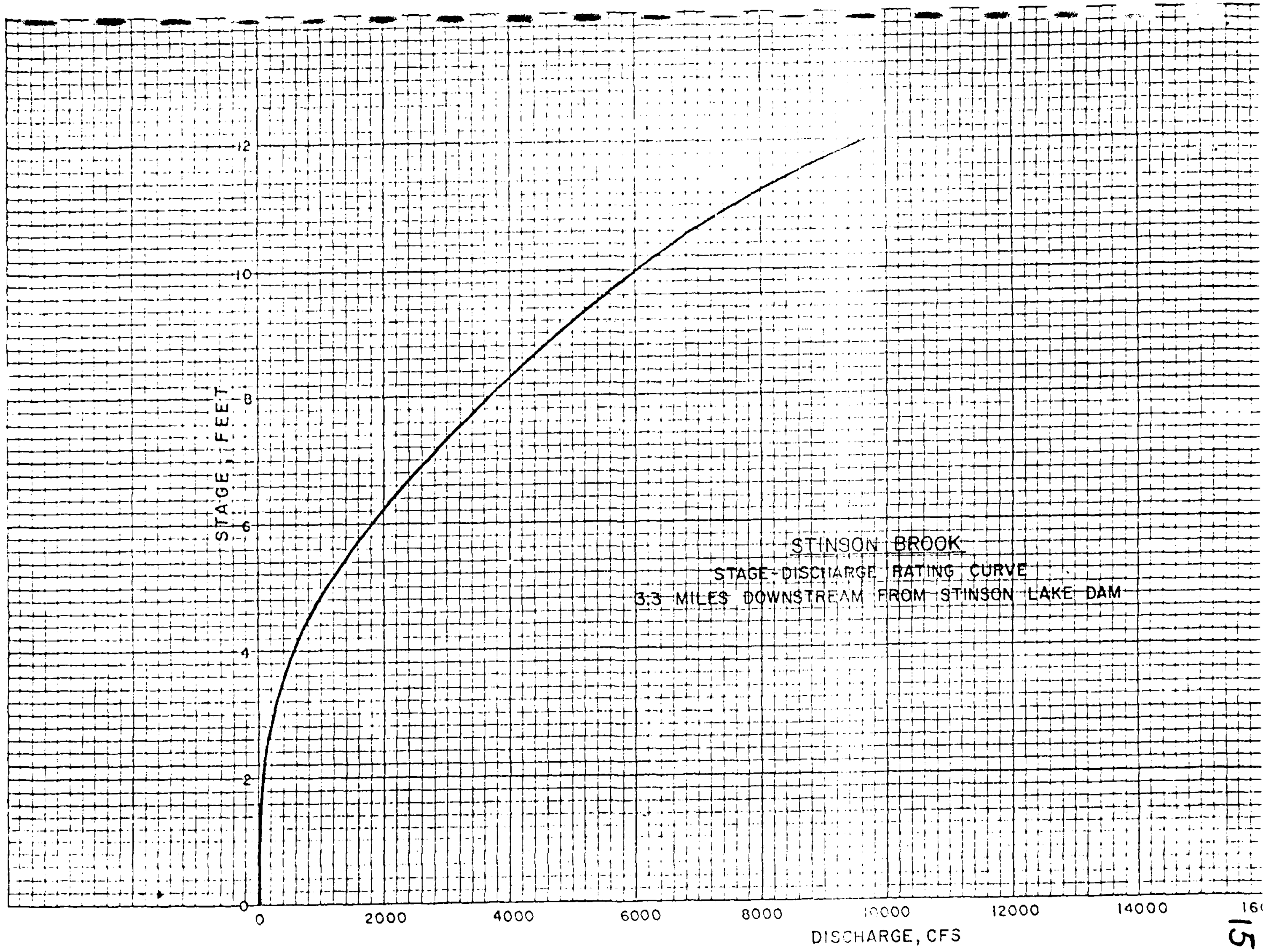

STINSON BROOK
STAGE-DISCHARGE RATING CURVE
BELOW STINSON LAKE DAM SITE
STAGE, FEET
0
2
4
6
8
10
12
DISCHARGE, CFS
0
2000
4000
6000
8000
10000
12000
14000
16000

12



STINSON BROOK
STAGE-DISCHARGE RATING CURVE
ONE MILE DOWNSTREAM FROM STINSON LAKE DAM
STAGE, FEET
0
2
4
6
8
10
12
0
2000
4000
6000
8000
10000
12000
14000
16C
DISCHARGE, CFS


STINSON BROOK
STAGE-DISCHARGE RATING CURVE
TWO MILES DOWNSTREAM FROM STINSON LAKE DAM
STAGE, FEET
0
2
4
6
8
10
12
DISCHARGE, CFS
0
2000
4000
6000
8000
10000
12000
14000
16C


STINSON BROOK
STAGE-DISCHARGE RATING CURVE
3.3 MILES DOWNSTREAM FROM STINSON LAKE DAM
STAGE, FEET
0
2
4
6
8
10
12
0
2000
4000
6000
8000
10000
12000
14000
DISCHARGE, CFS

HEC-1 COMPUTATIONS

```
****************************
HEC-1 VERSION DATED JAN 1973

****************************
```

DAM SAFTEY INSPECTION - NEW HAMPSHIRE
STINSON LAKE DAM
PMP FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
60	0	30	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	1.00	0.00	1.00	0.00	0.000	0	0	0

INPUT HYDROGRAPH

0.	957.	1914.	2871.	3829.	4786.	5743.	6700.	7657.	8614.
9571.	10529.	11486.	12443.	13400.	12507.	[illegible]	10720.	9827.	8933.
8040.	7147.	6253.	5360.	4467.	3573.	[illegible]	1787.	893.	0.
0.	0.	0.	0.	0.	0.	[illegible]	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13400.	10640.	4047.	3238.	194300.
INCHES		98.97	150.62	150.62	150.62
AC-FT		5278.	8033.	8033.	8033.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU STINSON LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

16

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

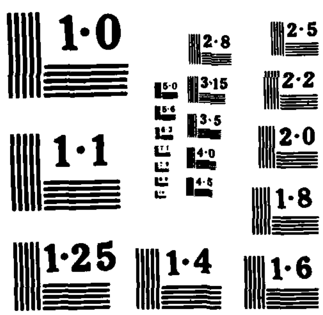
NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	[illegible]	0.000	[illegible]	-1.

STORAGE=	7000.	7350.	7700.	8050.	8400.	8750.	9100.	9450.	9800.	10150.
OUTFLOW=	0.	395.	1150.	2180.	3280.	4750.	6650.	8357.	10900.	13400.

TIME	EOP STOR	AVG IN	EOP OUT
1	7000.	0.	0.
2	7013.	478.	21.
3	7076.	1435.	[illegible]
4	7169.	2392.	[illegible]
5	7297.	3350.	[illegible]
6	7455.	4307.	[illegible]
7	7638.	5264.	[illegible]
8	7842.	6221.	[illegible]
9	8061.	7178.	2214.
10	8290.	8135.	2936.
11	8527.	9092.	[illegible]
12	8763.	10050.	4825.
13	8993.	11007.	[illegible]
14	9213.	11964.	[illegible]
15	9428.	12921.	[illegible]
16	9598.	12953.	[illegible]
17	9692.	[illegible]	[illegible]
18	9735.	11166.	[illegible]
19	9725.	10273.	[illegible]
20	[illegible]	[illegible]	[illegible]
21	[illegible]	8486.	[illegible]
22	9557.	7533.	[illegible]
23	9469.	6700.	[illegible]
24	9369.	5806.	[illegible]
25	9255.	4913.	[illegible]
26	9127.	4020.	[illegible]
27	8991.	3126.	[illegible]
28	8849.	2233.	[illegible]
29	8701.	1340.	[illegible]
30	8545.	446.	[illegible]
31	8397.	0.	[illegible]
32	[illegible]	0.	[illegible]
33	8159.	0.	[illegible]
34	8061.	0.	[illegible]
35	7974.	0.	[illegible]
36	7898.	0.	[illegible]
37	7831.	0.	[illegible]
38	7771.	0.	[illegible]
39	7718.	0.	[illegible]
40	7670.	0.	[illegible]
41	7627.	0.	[illegible]
42	7588.	0.	[illegible]
43	7552.	0.	[illegible]
44	7519.	0.	761.
45	7489.	0.	[illegible]

AD-A156 513 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS STINSON LAKE DAM (NH..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV OCT 78 2/2

UNCLASSIFIED F/G 13/13 NL


1·0
2·8
2·5
3·15
2·2
3·5
2·0
4·0
1·1
4·5
1·8
1·25
1·4
1·6

46	7462.	0.	636.
47	7436.	0.	582.
48	7413.	0.	532.
49	7392.	0.	487.
50	7373.	0.	445.
51	7355.	0.	407.
52	7339.	0.	383.
53	7324.	0.	365.
54	7309.	0.	349.
55	7295.	0.	333.
56	7281.	0.	317.
57	7268.	0.	303.
58	7256.	0.	289.
59	7244.	0.	276.
60	7233.	0.	263.
SUM			188773.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10392.	9046.	3875.	3146.	188773.
INCHES		84.15	144.19	146.33	146.33
AC-FT		4488.	7690.	7804.	7804.

18

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	13400.	10640.	4047.	3238.	1.00
ROUTED TO	1	10392.	9046.	3875.	3146.	1.00

19
59

```
***************************
HEC-1 VERSION DATED JAN 1973

***************************
                         DAM SAFTEY INSPECTION - NEW HAMPSHIRE
                                  STINSON LAKE DAM
                          ONE HALF OF PMP FLOOD

                                  JOB SPECIFICATION
            NQ    NHR   NMIN   IDAY    IHR   IMIN METRC   IPLT   IPRT NSTAN
            60      0     30      0      0      0     0      0      0      0
                                JOPER     NWT
                                    3       0


   **********        **********        **********        **********        **********

                            SUB-AREA RUNOFF COMPUTATION

                    INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

            ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
                1       0       0       0       0       0       1

                                   HYDROGRAPH DATA
   IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
      -1       0    1.00    0.00    1.00    0.00   0.500       0       0       0

                                 INPUT HYDROGRAPH
      0.      957.     1914.     2871.     3829.     4786.     5743.     6700.     7657.     8614.
   9571.    10529.    11486.    12443.    13400.    12507.    11613.    10720.     9827.     8933.
   8040.     7147.     6253.     5360.     4467.     3573.     2680.     1787.      893.        0.
      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.

                         PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                 CFS    13400.    10640.     4047.     3238.        194300.
              INCHES               98.97    150.62    150.62         150.62
               AC-FT                5278.     8033.     8033.          8033.

                           RUNOFF MULTIPLIED BY 0.50
      0.      478.      957.     1435.     1914.     2393.     2871.     3350.     3828.     4307.
   4785.     5264.     5743.     6221.     6700.     6253.     5806.     5360.     4913.     4466.
   4020.     3573.     3126.     2680.     2233.     1786.     1340.      893.      446.        0.
      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.

                         PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                 CFS     6700.     5320.     2025.     1619.         97150.
              INCHES               49.48     75.31     75.31          75.31
```

20
510

AC-FT	2639.	4016.	4016.	4016.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU STINSON LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	7000.	7350.	7700.	8050.	8400.	8750.	9100.	9450.	9800.	10150.
OUTFLOW=	0.	395.	1150.	2180.	3280.	4750.	6650.	8357.	10900.	13400.

TIME	EOP STOR	AVG IN	EOP OUT
1	7000.	0.	0.
2	7009.	239.	10.
3	7038.	717.	43.
4	7084.	1196.	95.
5	7148.	1675.	167.
6	7228.	2153.	258.
7	7324.	2632.	366.
8	7433.	3110.	575.
9	7552.	3589.	832.
10	7680.	4067.	1108.
11	7815.	4546.	1480.
12	7952.	5025.	1894.
13	8093.	5503.	2316.
14	8235.	5982.	2763.
15	8379.	6460.	3214.
16	8503.	6476.	3714.
17	8591.	6030.	4084.
18	8648.	5583.	4323.
19	8679.	5136.	4453.
20	8688.	4690.	4491.
21	8678.	4243.	4451.
22	8654.	3796.	4347.
23	8616.	3350.	4187.
24	8567.	2903.	3982.
25	8509.	2456.	3739.
26	8443.	2010.	3462.
27	8370.	1563.	3188.
28	8290.	1116.	2935.
29	8202.	670.	2659.
30	8107.	223.	2362.
31	8016.	0.	2080.
32	7935.	0.	1841.

21

s''

33	7863.	0.	1630.
34	7799.	0.	1443.
35	7743.	0.	1278.
36	7693.	0.	1136.
37	7648.	0.	1039.
38	7607.	0.	950.
39	7570.	0.	869.
40	7535.	0.	795.
41	7504.	0.	727.
42	7475.	0.	665.
43	7449.	0.	608.
44	7424.	0.	556.
45	7402.	0.	509.
46	7382.	0.	465.
47	7364.	0.	426.
48	7347.	0.	392.
49	7331.	0.	374.
50	7316.	0.	357.
51	7302.	0.	340.
52	7288.	0.	325.
53	7275.	0.	310.
54	7262.	0.	296.
55	7250.	0.	282.
56	7239.	0.	270.
57	7228.	0.	257.
58	7217.	0.	245.
59	7208.	0.	234.
60	7198.	0.	224.
SUM			92456.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4491.	4037.	1882.	1540.	92456.
INCHES		37.56	70.05	71.67	71.67
AC-FT		2003.	3736.	3822.	3822.

22

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	6700.	5320.	2023.	1619.	1.00
ROUTED TO	1	4491.	4057.	1882.	1540.	1.00

23
5/6

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
NH	399	NED	NH	009	02				STINSON LAKE DAM	4351.7	7148.5	15OCT78

POPULAR NAME	NAME OF IMPOUNDMENT
	STINSON LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	05	STINSON BROOK	RUMNEY	0	870

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)
PGER	1955	R	10	8	8400	7000

DIST OWN FED R PRV/FED SCS A VER/DATE

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	158	C	100	3360												

OWNER	ENGINEERING BY	CONSTRUCTION BY
NH WATER RES BD	OWNER	OWNER

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
HARRIS-ECI ASSOCIATES	05JUN78	PL 92-367

REMARKS